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IX INTERNATIONAL BOTANICAL CONGRESS

MONTREAL, AUGUST 19-29, 1959

VOLUME II
ABSTRACTS
RÉSUMÉS

COMPTES RENDUS DU

IX CONGRÈS INTERNATIONAL DE BOTANIQUE

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Foreword

This Volume of the Proceedings (Volume II) includes all abstracts of invited and contributed papers received before May 15, 1959. It is intended to be used as an adjunct to the Program (Vol. I of the Proceedings).

In the Program the titles and authors of papers are listed in the sequence in which they will be presented, the program of each Section being given separately. An Index to authors' names readily permits location of a specific paper.

In Volume II the abstracts are arranged alphabetically by authors' names with cross references where there is more than one author for a paper. By using the Program and Abstract Volumes together a member of the Congress can readily locate and read the abstract of any paper listed in the Program.

Avant-propos

Ce volume II des Procès-verbaux contient tous les résumés des exposés sollicités et soumis qui ont été reçus antérieurement au 15 mai 1959. Il est destiné à servir de complément au Programme (vol. I des Procès-verbaux).

Dans le Programme, les titres et auteurs des exposés sont classés dans l'ordre suivant lequel ils seront lus, le programme de chaque section faisant l'objet d'un groupement distinct. Un index des noms d'auteurs permet de trouver promptement l'emplacement d'un exposé donné.

Dans le volume II, les exposés sont disposés alphabétiquement par noms d'auteurs, avec renvois dans le cas où plusieurs auteurs ont signé le même article. Par l'emploi simultané du Programme et du recueil d'exposés, les Congressistes pourront rapidement retrouver et lire le condensé de tous les exposés qui figurent au Programme.

IX INTERNATIONAL BOTANICAL CONGRESS

ABDURASHITOV, S. A. *See* SHKOLNIK, M. YA., *et al.*

ADAMS, HELEN H., and CARL L. WITHNER. L. Sherman Adams Co., Wellesley, Massachusetts, and Brooklyn College. *Evolutionary Relationships of Cattleya Orchids.* This study concerns an attempt to work out evolutionary interrelationships that exist among the members of the orchid genus *Cattleya.* These plants grow in relatively circumscribed areas of Central and South America and produce many natural hybrids. Illustrations of cattleyas have been published in orchid literature for at least one hundred years and provide a valuable pictorial record that may, in effect, be used as a population study. We have applied the introgression study techniques developed by Edgar Anderson to show that hybridization and introgression among the cattleyas and laelias and their relatives can account for much of the present variation and difficulty in classifying the members of these taxa. Three main interrelated hybrid foci about which the *Cattleya* relationships have evolved are indicated: (1) *Laelia purpurata* and *C. labiata*; (2) *C. intermedia* and *C. loddigesii*; (3) *C. guttata* and *C. bicolor.* What may be called "*Schomburgkia* characteristics" have particularly infiltrated the "bifoliate" cattleyas comprising groups (2) and (3); the laelias and brassavolas have had more introgression with the populations of group (1). Scoring of the petal and sepal width-length ratios, the veining, shape, and callus patterns of the labellum and the vegetative habits have provided the numerical data upon which the study is based.

ADAMSON, D. *See* ADAMSON, HEATHER

ADAMSON, DONALD, and HEATHER ADAMSON. University of Sydney. *Effect of Reduced Expansion and Turgor on Cell-wall Formation in Artichoke Tissue.* Synthesis of cell-wall material in tissue slices cut from Jerusalem artichoke tubers was not reduced when expansion was strongly inhibited by calcium chloride solution (0.005 *M* to 0.01 *M*). Auxin-induced expansion was accompanied by an increase in cell-wall formation which was less sensitive than the expansion to calcium inhibition. The addition of calcium to tissue undergoing rapid auxin-induced expansion completely inhibited expansion, but did not reduce wall formation for at least 20 hours after the calcium addition. In calcium-treated tissue, cell-wall synthesis decreased with increasing concentration of mannitol or sucrose in the external medium and was completely inhibited in fully plasmolysed tissue. The results show that cell-wall formation, in tissue capable of rapid expansion, may continue in the absence of expansion but is reduced under conditions of reduced turgor. A marked sensitivity of general wall metabolism to cell changes associated with the reduction of turgor pressure is likely.

ADAMSON, HEATHER, and D. ADAMSON. University of Sydney. *Auxin-induced Plasmolysis Shift in Pea Epicotyl Sections.* Plasmolysis of sections taken from the hook and sub-hook zones of etiolated pea epicotyls (var. Greenfeast) occurred in more dilute solutions in the presence of physiological concentrations of auxin (2,4-dichlorophenoxyacetic acid). The auxin-induced plasmolysis shift was not caused by dilution of the cell sap. Monovalent cations increased and divalent cations decreased the auxin effect. The sensitivity of the plasmolysis shift to certain metabolic inhibitors will be described. It is suggested that the change in plasmolysis behaviour due to auxin may reflect changes in the interconnections between cytoplasm and cell wall.

ADAMSON, HEATHER. *See* ADAMSON, DONALD

ADDICOTT, F. T. *See* CARNS, H. R., *et al.*

AIKMAN, J. M., and J. H. EHRENREICH. Iowa State College and U.S. Forest Service. *Effects of Burning on Prairie Vegetation.* Numerous conflicting statements occur in the literature relative to the role of fire in the origin, development, and maintenance of prairie. Data obtained from prescribed burning experiments in northeastern Iowa are being used as the basis of a re-evaluation of effects of fire on an upland prairie developed under the mesic conditions of the northern border of the prairie peninsula. This luxuriant virgin prairie was mowed for hay almost every year for 80 years followed by a period of 10 years of complete protection under which litter and duff increased rapidly for three years, from ½ ton per acre to 2 tons, and then the curve gradually leveled off at about 3 tons per acre in the eighth, ninth, and tenth years. The effects of burning after 10 years of protection were: a forcing of the plants which increased in degree with increased number of annual burnings; earlier maturity by one to three weeks; a threefold increase in number of seedstalks of the prairie grasses after one burning to a fivefold increase following four or five annual burnings; an increase in height of mature plants, to 25 per cent; an insignificant increase in yield but a decrease in the proportion of leaves to seed stalks; a reduction in number of seed stalks and vegetative stems of competing bluegrass, redtop, and timothy; a reduction in litter and duff from 3 tons to averages of about ½ ton after one burning to no measurable quantity following four or five burnings. One burning followed by annual mowing increased the vigor, growth rate, and yield of the prairie vegetation.

AJELLO, LIBERO. U.S. Public Health Service. *Isolation of Histoplasma capsulatum from Soil.* Soil surveys are one of the most productive means for obtaining information relative to the ecological relations and geographic distribution of human pathogenic fungi and the epidemiology of the mycoses. Since 1950 several thousand soil samples from various parts of the world have been screened at the Communicable Disease Center (Atlanta, Georgia) for the presence of *Histoplasma capsulatum. H. capsulatum* was recovered from chicken and grackle habitats in the United States, Panama, and Peru, from oil bird (*Steatornis caripensis*) caves in Peru, Trinidad, and Venezuela, and from arboreal bat roosts in Trinidad. The significance of the association of *H. capsulatum* with certain animal habitats will be discussed along with the epidemiologic importance of these findings.

AJELLO, LIBERO. *See* MCDONOUGH, E. S., *et al.*

AKHUND-ZADE, I. M. Moscow. *The Results of Naturalization and Acclimatization of Subtropical Plants in Azerbaijan.* The present paper consists of four sections. The first section is devoted to the division of Azerbaijan into agro-ecological regions and to its systems. In the second section the term subtropics is defined and a description is given of subtropical plants. The subtropics are regarded as a natural-historical zone distinguished by the following characteristic peculiarities: (*a*) a clearly marked succession of thermal seasons of the year (spring, summer, autumn, winter); (*b*) a brief, unstable and mild winter; (*c*) the possibility of cultivating subtropical trees and shrubs on a commercial scale in the open ground under the existing natural-historical conditions; (*d*) the presence of a definite set of species (originally wild or which have become wild) of arborescent and herbaceous plants (indicators) that accompany the preceding group. Section three contains materials on introduction, naturalization, and acclimatization. Introduction includes naturalization—the adaptation of the introduced plants themselves to the conditions of existence in the new environment by manifesting and developing their potentialities that were latent in their natural or commercial habitat; it also includes acclimatization, or the process of directed alteration of the nature of plants by man with the purpose of adapting them to new living conditions. Section four contains information on the results of the introduction, naturalization, and acclimatization of subtropical plants in Azerbaijan: tea, saffron, olive, persimmon, the tung-tree, eucalyptus, bay (*Laurus nobilis*), bamboo, and citrus plants, eucommia, henna, pomegranate, figs, and nut trees; a list is given of the most important acclimatized subtropical exotic plants and their biological peculiarities and cultivation techniques in Azerbaijan.

AL-AISH, MATTI. University of Baghdad. *Grass Germination Responses to Isopropyl-phenyl Carbamate and Classification.* The responses of grasses to isopropyl-N-phenyl carbamate (IPC) vary among genera, tribes, and subfamilies, but the different responses are correlated with other systematic characters. With no exceptions, treated seed of species classified in the subfamily Festucoideae are completely inhibited by treatment; in fact, seed of most species germinate more quickly and in greater numbers than do the controls. Responses vary among genera of the group Phragmitiformes, indicating that this is probably an artificial aggregation. A satisfactory treatment for differentiating between the Festucoideae and the Panicoideae consists of treating dry seed for 24 hours in a 0.005 per cent solution followed by washing in water and further germination in petri dishes on filter paper moistened with water. The compound apparently affects some vital process of grass seedlings in the manner similar to strong solutions of 2,4-D but not as do sodium azide, sodium fluoride, or carbon monoxide. The implications of this study are that there is a physiological difference between the Festucoideae and the Panicoideae that is characteristic of these subfamilies.

ALAVA, REINO. *See* MATHIAS, MILDRED, *et al.*

ALEXANDER, L. J. *See* GALLEGLY, M. E.

ALLEN, ETHEL K., and O. N. ALLEN. University of Wisconsin. *The Scope of Nodulation among Members of the Family Leguminosae.* A long-term study was undertaken to ascertain the scope of nodulation of leguminous plants by the root nodule bacteria (genus *Rhizobium*). Nodulation data are recorded for 1,285 species contained in 243 genera, or about 50 per cent of the genera now included in the Leguminosae. Of these, 1,112 nodule-forming species are contained in 213 genera, non-nodulating ability characterizes 166 species in 30 genera, and conflicting information exists for seven species. In the Mimosoideae, the smallest subfamily of the Leguminosae, 127 nodulated and 19 non-nodulating species are listed in the 21 genera examined. The largest number of nodulated species in this subfamily and, incidentally, of any genus in the Leguminosae is contained in the genus *Acacia* where 68 of the 72 listed species are positive. Of the estimated 100 genera in the Caesalpinioideae, nodulation data are available on 108 species contained in 40 genera. Twenty-six species bear nodules and 82 species lack nodules. Members of the genus *Cassia* have received the most attention. Because of their economic value and widespread distribution, species in the subfamily Papilionoideae have dominated nodulation studies. Approximately 960 nodulating species are contained in 175 genera. Non-nodulation is comparatively rare. The largest listings of nodulated species occur in four genera, *Trifolium* (63), *Crotalaria* (53), *Desmodium* (52), and *Vicia* (49). This survey shows that about 85 per cent of the 1,285 species examined to date form nodules. However, only about 10 per cent of the number of species estimated for the Leguminosae have been examined.

ALLEN, MARY BELLE. Kaiser Foundation Research Institute, Richmond, California. *In vivo Transformations of Chlorophyll a in Ochromonas danica and Chlorella pyrenoidosa.* The suggestion has been made that chlorophyll is relatively inactive in the photosynthesis of some organisms because it exists in the plant in several forms, not all of which can catalyze the transformation of light energy into chemical energy. For this reason, among others, a number of photosynthetic organisms in which the *in vivo* absorption spectrum of chlorophyll *a* is complex, indicating the presence of more than one form of this pigment, are of interest. Young active cells of *Ochromonas danica* display an unusually complex chlorophyll spectrum. This gradually changes to a simple one as the cultures age. The transformation from a complex to a simple spectrum can be accomplished quickly by breaking the cells or, without cell breakage or loss of viability, by mild heating. The change in spectrum shifts the absorption toward shorter wave lengths and is accompanied by a shift in fluorescence maximum from 690-692 mμ to 678 mμ. In *Chlorella pyrenoidosa*, which also exhibits a complex chlorophyll spectrum, the proportions of the different components cannot be altered by such methods. They are, however, changed in a number of mutants which have been obtained. The significance of the different forms of chlorophyll for the photosynthesis of these organisms will be discussed.

ALLEN, O. N., J. G. DICKSON, A. L. FLANGAS, and D. W. BENO. University of Wisconsin. *The Genetic Analysis of Pathogenicity and Serology of Puccinia sorghi Schw.* Inbreeding *P. sorghi* for genetic analysis of pathogenicity and serology was initiated following studies on physiological races. Four urediospore clones differentially pathogenic in the uredial stage were inbred through the alternate host, *Oxalis*, and recombinant lines compared with the mother clones. Pathogenicity changes were induced as scored on inbred lines of maize containing dominant, mutant alleles isolated from a single gene locus conditioning resistance and susceptibility (allelic differential hosts). The aecial, inbred recombinants reflected dimensional changes from original pathogenicity of clones, that is, an ultimate gain or loss in host range or specificity. Based on reaction type on allelic differential hosts, continued inbreeding did not segregate homozygous pathogenic complements into distinct pathogenic biotypes. The same gamut of pathogenic types was produced after each generation of inbreeding. Hybridization of selected pathogenic types of sibling and non-sibling pedigree confirmed the indeterminate nature of the pathogenic locus. Antisera produced from the pathogenic types differentiated the homologous from the heterologous combinations and revealed cross-reactions with *P. graminis avenae*. On the basis of genetic origin of variability in pathogenic specificity, a "cistron" (Benzer, 1957) is postulated as the genetic unit conditioning specificity capable of intracistron recombination which modifies pathogenicity.

Allen, O. N. *See* Allen, Ethel K.; Roslycky, E. B., *et al.*

Alvim, Paulo de T. Interamerican Institute of Agricultural Sciences, Lima, Peru. *Stomatal Opening as a Practical Indicator of Water Stress in Plants.* The author indicates the importance of utilizing the plant rather than the soil as an indicator of water deficiency, that is, to determine when plants should be watered. He presents the results of his studies with sugarcane, wheat, and cacao on the diagnosis of water shortage by means of evaluating the degree of stomatal aperture. Most of these studies have been carried out under field conditions in the dry coastal area of Peru. Stomatal aperture was estimated by an improved infiltration technique, using a series of solutions made up of Nujol and Xylol or Nujol and kerosene, mixed in different proportions, as proposed in a previous paper by Alvim and Havis. The results show that stomatal aperture decreases much before water content in the soil reaches the so-called "permanent wilting point." In general, maximum stomatal aperture was only attained when soil moisture content was in the upper third of the "available range." The method is proposed as a practical way of determining the frequency of irrigation or when plants should be watered. A solution made up of 80 per cent Nujol and 20 per cent Xylol or kerosene can apparently be used to indicate "drought threshold" in sugarcane and wheat. For cacao, which has smaller stomata, a solution with 40 per cent Nujol and 60 per cent Xylol or kerosene is recommended. The advantages of this method as compared to techniques based on soil moisture studies are discussed.

Alvin, Kenneth. Birkbeck College, University of London. *A New Shoot Belonging to the Pinaceae from the Wealden of Belgium.* Fossil pinaceous shoots preserved as lignite in clay from the Wealden of Belgium are described. The shoot morphology is still to some extent problematic: it is uncertain whether distinct dwarf shoots occurred. The material has been studied anatomically by means of microtome sections and also macerations. The leaf anatomy is known in some detail and has much in common with that of *Pinus*. Although the larger shoots contain a conventional woody cylinder, the vascular anatomy of some of the more slender shoots appears unique amongst conifers and presents morphological and developmental problems. The shoots are classified as a new species of *Prepinus* Jeffrey.

Ames, H. Tate. Pennsylvania State University. *Preliminary Report on the Wodehouse Pollen Types from the Green River Formation.* A re-examination of the Wodehouse pollen types from the Eocene of Western North America has resulted in (1) re-illustration of the holotypes by means of supplementary photomicrographs, (2) presentation of additional morphological detail, and (3) limited redescriptions as a supplement to this pioneer publication in American palynology, *Tertiary Pollen II, The Oil Shales of the Eocene Green River Formation,* by R. P. Wodehouse. The study and photographs were made from ground-thin sections of Green River shale originally prepared for study in 1914 by C. A. Davis. In addition a similar structural and sculptural development of the exine as observed in Green River Tsuga-like fossils and *Tsuga canadensis* is described and illustrated.

ANDERSON, EDGAR. *See* MEHRA, K. L.

ANDERSON, I. C., and D. S. ROBERTSON. Iowa State College. *Carotenoid Protection of Chlorophyll Photodestruction.* The photostability of chlorophyll in the presence and absence of colored carotenoids was studied in *Zea mays.* Seedlings of an albino mutant, white-3, and of the normal allele were grown in darkness. No colored carotenoids developed in the white-3 mutant seedlings; instead, large amounts of a carotene precursor, phytoene, accumulated in these plants. Equal amounts of protochlorophyllide *a* were formed in both types of seedlings and exposure of the leaves to light for one minute converted their protochlorophyllide *a* to chlorophyllide *a.* After one hour of darkness chlorophyllide *a* had been converted to chlorophyll *a.* In the presence of oxygen and strong light, chlorophyll was completely destroyed in the carotenoidless mutant within 15 minutes whereas chlorophyll of normal plants was rather stable to this treatment. Anaerobic conditions prevented the photodestruction of chlorophyll. White-3 seedlings accumulate appreciable amounts of chlorophyll when grown in very dim light and "chloroplasts" appear to be formed. Chlorophyll synthesis in the white-3 mutant seems to be normal and the failure to survive appears to be due to a genetic block of carotenoid formation. These results strengthen the hypothesis of a universal role of carotenoids in the protection of chlorophyll from photodestruction.

ANDERSON, LEWIS E. Duke University. *Cytotaxonomic Studies on North American Mosses.* Results of recent chromosome studies of mosses from several areas in North America, notably the Canadian Rocky Mountains, Hudson Bay, the Southern Appalachian Mountains, and the Atlantic Coastal Plain are summarized. Chromosome numbers and behaviour are discussed in relation to taxonomic groupings. Special attention is devoted to genera within the Ditrichaceae, Dicranaceae, Funariaceae, Meesiaceae, and Hypnaceae. At the specific level, *Fissidens, Ditrichum, Grimmia, Orthotrichum,* and *Polytrichum* are considered.

ANDREAE, W. A. Canada Department of Agriculture. *The Natural Auxins: Their Nature, Biosynthesis, and Some Aspects of Their Metabolism.* A number of substances have been found in plant tissues which by virtue of their activity in standard growth tests can be classified as auxins. The fact that IAA was identified and became available in pure form relatively early in the study of growth substances gave it an importance which at present may be considered as disproportionate. In recent years several indole compounds related to IAA have been isolated as well as a number of other growth active substances of unknown chemical composition. At present the pathways of biosynthesis and metabolism, even of the chemically defined indole compounds, have not been completely elucidated. While the conversion of indoleacetonitrile to growth active and growth inactive metabolites has been investigated, by far the majority of the studies on the metabolism of indole auxins have been concerned with IAA. By the use of labeled precursors and by analogous studies on micro-organisms evidence of the reactions leading to IAA synthesis in plants is accumulating. The difficulty of demonstrating IAA synthesis in higher plants lies, in part at least, in the instability of IAA within the tissues for it has been shown that IAA applied to plants undergoes degradation, conjugation, and protein binding. Whilst conjugation and degradation reactions apparently are unrelated to the stimulating action of IAA they may fulfil an important role in maintaining the internal auxin content below toxic levels.

ANDREWS, HENRY N., JR., and WILLIAM H. MURDY. Washington University, St. Louis, Missouri. *Ontogeny in Arborescent Lycopods.* Although the arborescent Carboniferous lycopods are generally considered to be well-known fossil plants, very little concise information is available concerning their mode of growth. We have been concerned chiefly with the growth of the primary trunk, which is known to have attained a height of 114 feet before the first branching occurred, and with the problem of apparent finite growth resulting from the progressively smaller branches following the initial dichotomy of the primary trunk. The discovery of *Lepidophloios* stem specimens with very little secondary tissue (bark or wood) sheds some light on the growth of the trunk, and certain aspects of the foliage are considered in connection with photosynthetic problems involved in this unique type of growth. The anatomy of various branch orders is considered in support of our supposition that finite longitudinal growth characterized the shoot system.

ANDREWS, HENRY N., JR. *See* LECLERCQ, SUZANNE

ANDREWS, JOHN EDWIN. Experimental Farm, Lethbridge, Alberta. *Effect of Duration of Hardening and Variation in Hardening Temperature on Cold Hardiness of Sprouting Wheat.* The cold hardiness of sprouting winter wheat seeds, as measured by exposure to –15° C. for 16 hours, increased rapidly during the first five weeks of hardening and decreased rapidly between the seventh and eleventh week of hardening at 1.5° C. in the dark. With a slightly higher hardening temperature (3.5° C.) in the dark, a lower level of cold hardiness resulted; cold hardiness reached a maximum with four weeks of hardening and then decreased. Material grown at +5° C. did not develop sufficient cold hardiness to withstand the freezing temperature. The application of supplementary light during hardening at 3.5° C. resulted in a slight increase in average hardiness, but did not prevent the rapid decrease in hardiness after the fourth week of growth. Sprouting winter wheat will harden to cold in the dark. The ultimate level of cold hardiness attained depends on the hardening temperature, duration of hardening, and stage of development of the seedling. Small changes in these factors can result in large differences in cold hardiness.

ANET, E. F. L. J. *See* GORHAM, P. R., *et al.*

ARISZ, W. H. Botanical Laboratory, Groningen, Netherlands. *Observations on Translocation in Parenchyma and Their Significance for Long-distance Translocation.* The leaves of *Vallisneria,* a submerged water plant, form a simple system capable of considerable transport. Translocation of locally applied substances can be measured in adjacent leaf segments. Radioactive P and Rb supplied to the tips of the older leaves of intact plants are accumulated in the youngest leaf as in land plants. Experiments with excised leaves show that transport is not polar since simultaneous transport of two substances, potassium chloride and asparagine, in opposite directions through the same leaf length takes place without interference. The path of transport can be studied by making bridges either of parenchyma cells or of bundles between the absorbing and the translocating part of a leaf. Both types of bridges allow transport, but over longer distances isolated bundles are more efficient. Protoplasmic streaming is not involved in salt transport since, in solutions with potassium or calcium, streaming does not occur while salt translocation is considerable. In *Vallisneria* leaves, walls do not participate in salt transport. A suction force applied to the distal end of a leaf length does not enhance transport. On the contrary, it reduces absorption and translocation. Translocation in *Vallisneria* leaves is confined to the symplasm to which both parenchyma and sieve tubes belong. (Refer to author's abstract in the symposium "The Role of Protoplasm in Uptake and Transfer of Ions.")

ARISZ, W. H. Botanical Laboratory, Groningen, Netherlands. *Symplasm Theory of Salt Uptake and Transport in Parenchymatic Tissue.* Plasmatic connections between protoplasts have been known for a long time. Münch supposed that substances produced by photosynthesis are translocated in the symplasm through plasmodesmata from cell to cell. A modern symplasm theory should allow for active uptake as well as for translocation in the symplasm. Such a theory would not involve a rejection of the free space theory since the loss of ions to the medium may be prevented by attachment to plasmatic carriers instead of by a membrane. Streaming of protoplasm is not required for translocation. Uptake and transport have been studied in leaves of *Vallisneria*. In the dark the uptake is small. It is promoted by light, even in the absence of carbon dioxide, and also by sugar. Van Lookeren Campagne found that the action spectra of chloride absorption and of photosynthesis were identical, indicating that chlorophyll is active in both processes. Light energy is transformed into chemical energy and used in the absorption process. Uptake can use stored energy from a preceding exposure to light or respiration energy. This proves that, besides Lundegardh's anion respiration, another system exists using light energy. A scheme will be discussed for uptake and transport based on the influence of light, sugar, or inhibitors applied in different zones of the same leaf length. Their effects on the absorbing zone may differ from their effects on the adjoining zone which receives the ions only via the absorbing zone. This difference points to a special uptake process since the influence on the accumulation in the vacuoles in both zones will be identical. Substances from outside transferred into the central plasm (metabolic pool) are accumulated in the vacuoles or translocated in the symplasm. Chloride once accumulated in the vacuoles is not given off to the medium. Leakage into the cytoplasm is small and there is no easy exchange between ions accumulated in neighbouring vacuoles.

ARK, PETER A. *See* DEKKER, J.

ARNOLD, CHESTER A., and J. STEWART LOWTHER. University of Michigan and College of Puget Sound. *The Age of the Cretaceous Nanushuk Flora of Northern Alaska.* The Nanushuk group of northern Alaska has yielded a flora of 46 species belonging to 26 genera. There are 8 ferns, 6 cycadophytes, 12 ginkgophytes, 11 conifers, and 5 angiosperms. Five of the species are not known to occur elsewhere above the Jurassic, several others occur in the Jurassic and Neocomian, and still others are mainly Early Cretaceous types. Six species are known to range into the Late Cretaceous. The flora contains none of the species which elsewhere characterize Albian or Cenomanian floras. The flora as a whole is one of mid-Mesozoic aspect with typical Jurassic and Early Cretaceous types occurring in about equal numbers. However, a few angiosperms seem to tip the balance in favor of Early Cretaceous age. An Aptian age is the youngest that seems consistent with the floral evidence.

ARNON, D. I. *See* TREBST, A. V., *et al.*

ARNON, DANIEL I. University of California. *The Chloroplast as a Functional Unit in Photosynthesis.* The evolution of biochemical evidence will be traced in support of the current concept that chloroplasts are complete photosynthetic units capable of forming carbohydrates from CO_2 and water with a simultaneous evolution of oxygen, with no energy supply except visible light. The fractionation of the photosynthetic apparatus in chloroplasts has led to a physical separation of photosynthesis into a light and dark phase. During the light phase oxygen is evolved and light energy is converted into "assimilatory power" used during a subsequent dark phase for the assimilation of CO_2 to the level of carbohydrates (Science *127*: 1026, 1958; Nature *182*: 351, 1958). The individual photochemical reactions in chloroplasts will be discussed in relation to the dark reactions for CO_2 assimilation. Photosynthesis in green plants and photosynthetic bacteria will be compared on the basis of the photosynthetic reactions which have been identified in isolated chloroplasts and bacterial chromatophores.

ARNON, DANIEL I. University of California. *Conversion of Light into Chemical Energy in Photosynthesis.* It has long been recognized that photosynthesis includes a dark phase (Blackman reaction) which is responsible for the assimilation of CO_2 at the expense of light energy trapped during the light phase of the process. By fractionating chloroplasts, it has been possible to separate these two phases of photosynthesis (Nature *182:* 351, 1958) and to study the key problem of photosynthesis, the conversion of light into chemical energy, independently of the dark reactions of CO_2 assimilation. The two photochemical reactions during which the energy conversion process takes place have been designated as cyclic and non-cyclic photophosphorylation (Science *127:* 1026, 1958). Their products are $TPNH_2$, ATP, and O_2. On the basis of recent experiments on the role of chloride and ferricyanide in the photochemical reactions of isolated chloroplasts and bacterial chromatophores, a new hypothesis will be presented for the mechanism of conversion of light into chemical energy in photosynthesis.

ARNOTT, HOWARD J. Northwestern University, Evanston, Illinois. *The Cotyledon of Yucca.* The cotyledons of several species of *Yucca* were investigated using clearings in conjunction with serial microtome sections. In seedlings cleared in 5 per cent NaOH and concentrated chloral hydrate, the course of vascular bundles and xylem development were effectively studied. The cotyledon of *Yucca* is composed of three major parts: a terminal haustorium, a middle region, and a basal sheath. Under uniform growth conditions the proportional size of these zones varies in different species. A mature cotyledon has the haustorium embedded in the seed; depending on seed depth, the middle region may be arched or straight, the overground portions being photosynthetic; the basal sheath surrounds the epicotyl and acts as an environmental buffer. The four meristems involved in the development of the cotyledon are: apical, marginal, pseudomarginal, and intercalary. The apical meristem functions only during embryogeny while the other three are active mainly during and after germination. Cotyledonary trace-number is relatively species-constant. The number of cotyledonary traces varies from two to ten. The cotyledonary venation shows simple modifications of an open dichotomous system. Stomata are found on all portions of the cotyledon.

ASHTON, DAVID H. Madingley Hall, Cambridge, England. *Growth under Shade and the Compensation Points of Eucalyptus regnans.* *E. regnans* is confined to the temperate mountainous areas of southeastern Australia. Regeneration in the mature, even-aged, pure forests is rare in the absence of fire; large gaps are necessary, and failure is complete under the canopy of the understorey. The light compensation points were investigated in both the laboratory and glasshouse. The light intensity at which the net gas exchange was zero was called the absolute compensation point. This greatly increased with temperature and the developmental sequence of seedlings, and decreased slightly with high CO_2 concentration and low carbohydrate status. The average light intensity at which the net assimilation rate was zero was called the seasonal compensation point. This fell sharply from summer to winter and was correlated with the mean temperature. The effect of shade was greatest below 20-30 per cent daylight. Seedlings were etiolated at 11 per cent, stunted at 5 per cent, and at the seasonal compensation point at 1½ per cent daylight. Root growth and mycorrhizal frequency were greatly reduced below 11 per cent daylight. In the forest, survival under light and moderate shade is dependent on wallaby grazing, summer soil moistures, and winter leaf spot fungi. The reduction of light intensities and sunfleck frequency in autumn and winter is vital, particularly where seedlings have developed vertically orientate foliage.

ASHTON, FLOYD M. University of California. *The Effect of 3-(p-chlorophenyl)-1,1-dimethylurea on the Rate of Photosynthesis.* The study reported here involves the effect of 3-(p-chlorophenyl)-1,1-dimethylurea on the rate of photosynthesis of red kidney bean plants. The rate of photosynthesis was measured by $C^{14}O_2$ fixation. The experimental plants were grown in sand culture and irrigated twice a day with a double strength Hoagland's solution. The plants were treated with 3-(p-chlorophenyl)-1,1-dimethylurea at concentrations of 0.1, 1.0, and 10.0 p.p.m. 10 days after planting. Photosynthetic measurements were taken 2, 4, and 8 hours after the addition of the herbicide. No reduction in the rate of photosynthesis was detected with 0.1 p.p.m. at these time intervals; with 1.0 p.p.m. the rate of photosynthesis was reduced to 68.4 per cent at 4 hours and 30.5 per cent at 8 hours, no reduction was detected at 2 hours; with 10.0 p.p.m. the rate of photosynthesis was reduced to 6.5 per cent at 2 hours, 2.9 per cent at 4 hours, and 1.5 per cent at 8 hours.

ASOMANING, E. J. A., and A. W. GALSTON. Yale University. *The Effects of Pre-irradiation with Red and Blue Light on Pigment Content and Phototropic Sensitivities of Oat and Barley Coleoptiles.* Coleoptiles of barley (var. Oderbrucker) are about a thousand times less sensitive to unilateral blue light than those of oats (var. Clinton). Whereas oat coleoptiles subject to low intensities of blue irradiation follow the reciprocity law, barley coleoptiles deviate markedly from reciprocity at all intensities from 0.5 to 27.0 ergs/cm.^{2}/sec. Oat coleoptiles are about ten times richer in carotenoids than are barley coleoptiles; in both plants the etiolated leaves contain greater quantities of the same carotenoids as are found in the coleoptiles, and coleoptile tips contain about four times as much pigment per unit fresh weight as the base. A xanthophyll is the dominant pigment in both, with lesser quantities of β-carotene and an unknown pigment also present. An "albino" barley mutant which is active phototropically has only traces of carotenoids. Red-light pretreatment of oat seedlings inhibits the growth of the first internodes and causes a drastic decrease in phototropic sensitivity of the coleoptiles. In barley, where the first internode is genetically repressed, pretreatment with blue or red light causes an enhanced phototropic sensitivity, blue light being the more effective. In both oats and barley, pre-irradiation increases the carotenoid content although it causes opposite effects on phototropic sensitivity.

ATABEKOVA, A. I. Faculté des Sciences, Moscow. *Polyploïdie spontanée du Lupinus (Tourn) L.* Le genre *Lupinus* se prête difficilement aux observations cariologiques: c'est là la cause de beaucoup d'erreurs dans la définition des nombres chromosomiques des espèces étudiées. D'après la littérature que nous possédons pour le moment, le nombre diploïde de chromosomes des différentes espèces de *Lupinus* est: 32, 36, 40, 42, 46, 48, 50 et 52. D'après les observations cyto-émbryologiques, le genre *Lupinus* se divise en deux groupes cariologiques selon l'origine géographique: méditerranéenne et américaine. Les *Lupinus angustifolius* L., *linifolius* Roth., et *pilosus* L. qui ont $2n = 40$, ainsi que les *L. albus* L. et *luteus* L., où $2n = 50$, appartiennent au premier groupe. Le *L. luteus* L. se caractérise par $2n = 52$. Pourtant cette espèce se distingue beaucoup des autres *Lupinus* du groupe américain par des particularités morphologiques et occupe une place quelque peu séparée. Parmi les espèces du groupe américain, les *L. arboreus* Sims., *barkeri* Lindl., *densiflorus* Bent., *douglasii* Agar, *elegans* H.B.K., *hartwegii* Lindl., *hybridus* Lem., *mutabilis* Sweet., et *nanus* ont toutes $2n = 48$, à l'exception de *L. subcarnosus* Hook et *L. texensis* Hook, dont le nombre est $2n = 34$. Ces deux groupes se présentent aujourd'hui sous la forme d'espèces avec des rapports du rang polyploïdiques. En ce qui concerne les espèces de *Lupinus* d'origine méditerranéenne, nous pensons que leur nombre chromosomique de base est $x = 5$, tandis que pour les espèces américaines il serait $x = 6$.

AUSTIN, S. W. *See* TURRELL, F. M., *et al.*

AVADHANI, P. N., and G. H. N. TOWERS. McGill University, Montreal. *Synthesis of Phloridzin and Related Phenolic Compounds in Malus Tissues from Cinnamic Acid-2-C¹⁴.* Extracts of *Malus* leaves have been found to contain phloridzin, phloretin, chlorogenic acid, p-coumaric acid, phloretic acid, and traces of ferrulic acid. Previous studies by A. Hutchinson have shown that the B ring and the C_3 moiety of phloridzin are formed from phenylalanine-C^{14} and tyrosine-C^{14} and not from acetate-C^{14}. In the present studies, cinnamic acid-2-C^{14} was administered to *Malus* tissues and radioactivity was found in phloridzin, phloretin, p-coumaric acid, and two unknown phenolic acids but not in phloretic acid. There was a greater incorporation of radioactivity from cinnamic acid-C^{14} into phloridzin and phloretin in leaf material fed in light, compared with that given dark feeding. Cinnamic acid was less readily utilized for the synthesis of phenolic substances in the dark. Progressive changes in the distribution of carbon-14 among the phenolic substances with time in the presence of cinnamic-C^{14} have been determined. Cinnamic-C^{14} was fed in the presence of possible precursors of phloridzin and changes in the distribution of carbon-14 were determined. The results of these studies will be discussed in relation to phloridzin biogenesis.

AVERY, GEORGE S. Brooklyn Botanic Garden, New York. *Lines of Communication between Professional Botanists and the Lay Public.* Except for a few botanic gardens and arboretums which offer popular short courses as part of a vital educational program for laymen, botanists in general lack channels of communication with the public. College and university courses reach but few people; most botanic gardens and arboretums can reach many. But reaching people at the "visitor level" is not enough; labeled plants in "family groups" are not enough. We must not be content with visitors who come at blossom time and say, "Look, isn't it pretty." We must set up popular classes, chiefly on ornamental plants and how to grow and use them. These short courses would meet only three to five times. The tuition charge should be modest, with plants, containers, etc., furnished by the botanic garden. We have a great opportunity for mass botanical communication with the lay public if we are willing to think of the public and its potentially generous support of botany at the recreational-educational level.

AVRORIN, N. A. Academy of Sciences, Kirovsk, U.S.S.R. *The Introduction of Plants into the Subarctic Zone.* Over four thousand introduced plant species have been tested in the open soil at the Arcto-Alpine Botanical Garden of the Kola Branch of the Academy of Sciences of the U.S.S.R. (Hortus Botanicus Arcto-Alpinus Filiae Kolaënsis Academiae Scientiarum U.R.S.S.) during the last twenty-seven years. This Botanical Garden is situated on the Kola peninsula, in the Khibiny Mountains, in the vicinity of Kirovsk (Murmansk Region), at 67°38′ N. For the first time, an assortment of hardy valuable ornamental plants (shrubs, perennial and annual plants) for the Soviet Subarctic has been created (see "Dekorativnyie rasteniya dlia Kraynego Severa S.S.S.R." (Ornamental plants for the extreme north of the U.S.S.R., 1958). Successful introduction into the Subarctic not only of northern and high-mountain plants, but of many steppe-zone, subtropical, and even tropical species, has been proved. This depends on the ecologico-geographical distribution of the plants, on the locality where their closest ancestors had been grown, on the history of the species and of the specimen tested, as well as on the adaptive characters, both morphological and physiological. A new method of analysis of phenological data, namely, the several-years chronograms, has made it possible to determine whether the acclimation process is taking place in the given plant, its duration, whether there are two stages in the course of acclimation, whether it is resumed in the closest progeny of the introduced specimen, as well as whether the time required for acclimation gradually decreases from generation to generation. It has been established that new races of plants originate as the result of acclimation, differing from the initial forms both in morphology and in function. It is thus of great significance as an experimental method of investigation in the theory of evolution, genetics, and biogeography, and as one of the principal means for stimulating the origin of new forms, some of which might prove to be useful for the purposes of practical selection.

AXELROD, DANIEL I. University of California. *Inferences Regarding Pre-Tertiary Angiosperm Evolution.* Evidence supports these inferences: angiosperms were present in the later Paleozoic, in upland tropical regions, undergoing quantum evolution; ancestry unknown, but a series of basic phyletic lines may have diverged almost simultaneously from the ancestral group, with the magnolian alliance representing only one of them (Nemejc). The basic pattern of adaptive radiation in the natural alliances was deployment within the tropics, with secondary adaptive types diverging into extratropical regions (Bews). The basic patterns of distribution were tropical; tropical and extratropical; tropical and boreal; tropical and austral; with dry and temperate derived. Angiosperms were undergoing adaptive radiation in upland regions into the Cretaceous. They first appear in the Cretaceous tropics (California, Portugal, Virginia) in the Necomian, they gradually invaded higher latitudes during the Aptian and Albian, and only replaced Jurassic-type vegetation at high latitudes during the early part of the Late Cretaceous. Distributional evidence provided by Late Cretaceous and Cenozoic tropical taxa suggests effective trans-tropical migration occurred during the earlier Mesozoic, and is supported by geological evidence. By the close of the Cretaceous the major Tertiary geofloras were largely discernible: Arcto-, Antarcto-, Neotropical-, Paleotropical-Tertiary, and with indications that the dry geofloras (Madro-Tertiary, Mediterrano-Tertiary, etc.) were now entering the lowland record over the drier tropic savannas.

BADENHUIZEN, N. P. University of the Witwatersrand. *Problems of Starch Formation.* The starch granule is a fascinating biological object because it reflects physiological and genetic conditions in the cells of a plant. Its formation requires a knowledge of *in vivo* processes which have hardly been touched upon, and can be explained only very partially by knowledge obtained *in vitro.* Recent investigations on high-amylose starch have shown that separate genes and their modifiers influence molecular shape, chemical composition, crystalline pattern, and molecular association in the starch granule, while changes may take place at a particular stage of development. Linked up with all these fundamental processes is the question of how it is possible that linear molecules are found in starch. The solution of the problems concerned with starch formation in the living cell lies in a vast, nearly unexplored field. Prerequisite is a thorough knowledge of structure, composition, and growth of the starch granule. Some of the factors that have to be studied are: the sugar-starch conversion, the interaction of the various enzymes involved in starch production, the influence of phosphate, substrate, and primers, the mechanism of enzyme formation, the complex of cell-physiological conditions, and conditions of precipitation in plastids in relation to their structure.

BAILEY, D. L. University of Toronto. *The Organization and Development of Plant Pathology.* Although the Canadian government entered the field of scientific agriculture in 1896 with the founding of the Dominion Experimental Farms, it was not until 1908 that a separate Division of Botany was created, under the direction of Dr. H. W. Güssow, with pathology as its most important initial activity. From this beginning a Dominion-wide plant pathological service was developed. Because of the tremendous area involved and the great diversity in crops encountered, regional laboratories, from one to four per province, were developed to study regional problems or regional expressions of more general ones. Later separate laboratories were organized to deal with regional forest pathological problems. These laboratories have been administered through the Dominion Department of Agriculture, initially in the Experimental Farms Branch, later in Science Service, and recently in the Research Branch. Plant Pathological Extension has been largely under provincial rather than Dominion aegis although spray calendar services have been co-operative between the two. Plant pathology was placed on the curriculum of the Ontario Agricultural College (Guelph) in 1898, which was probably the first formal recognition of the subject in university circles. Subsequently it came to be taught in all agricultural colleges, as well as in several university botanical departments. Post-graduate programmes leading to the M.A. and Ph.D. degrees were offered first in Toronto and McGill, but are offered at present in several other Canadian universities.

BAKER, HERBERT GEORGE. University of California. *Adventitious Embryony in Pachira (Bombacaceae) and Its Taxonomic Consequences. Pachira oleagina* was formally described by Decaisne (1880), from material growing in cultivation at Algiers. This species is now cultivated in many parts of tropical Africa and has promise as an economic plant. However, it has never been matched satisfactorily with any American collections although the genus *Pachira* is believed to be endemic to the New World. As early as 1866, Doumet had seen and drawn polyembryony in what was probably this species, and the same phenomenon was noted in an unidentified species in 1880 by Lynch and at about the same time by Homsley (unpublished). An experimental investigation of this species at Achimota, Ghana, by the present author has shown the necessity of pollination for seed-setting although plants are self-compatible. A sexually produced embryo is formed, but additional adventive embryos are budded into the embryo sac from the nucellus in the vicinity of the micropyle. Up to five embryos may be present at maturity. Reproduction is thus at least facultatively apomictic — the first record of apomixis in the Bombacaceae or, indeed, in the Malvales. Apomixis may be responsible for some of the taxonomic difficulties in *Pachira* although probably not all species show polyembryony. *P. oleagina* shows $2n=72$ chromosomes (also the commonest number in the genus *Bombax*) although there is a rather high degree of pollen sterility. However, there is no evidence of polyembryony in *Bombax*, which has much smaller seeds, and there appears every reason for keeping these genera separate taxonomically.

BAKER, JAMES E., and JOHN F. THOMPSON. U.S. Department of Agriculture. *Metabolism of Various Nitrogenous Compounds by Cells of Nitrogen-deficient Chlorella vulgaris.* In studying the changes in uncombined amino acids in *Chlorella* after ammonium chloride feeding, rapid rates of formation of alanine and glutamine were observed. (Reisner and Thompson, Plant Physiol. Suppl. 33: xi, 1958). Experiments to be described, in which sampling was done at shorter time intervals after ammonia feeding, and other experiments in which cells were suspended in sucrose have emphasized the rapid formation of alanine in relation to glutamate. Various inhibitors (2,4-dinitrophenol, desoxypyridoxine, glutarate, and methionine sulfoxide) have not selectively blocked either glutamate or alanine formation. However, when nitrogen is supplied as urea or carbamyl phosphate, the ratio of glutamate increase to alanine increase was much greater. Also, arginine as a source of nitrogen is different from citrulline and ornithine in that the relative increase of alanine to increase in glutamate is much higher. This is possibly due to liberation of ammonia from arginine by arginine desimidase since the desimidase is present in *Chlorella,* and citrulline is a predominant product of arginine decomposition by the cells. These points suggest that alanine formation after ammonia feeding is not entirely a result of transamination. Other salient features of arginine, citrulline, and ornithine metabolism by *Chlorella* will be mentioned.

BAKER, KENNETH F. University of California. *Control of Root Rot Diseases.* In the intensely competitive soil microflora, each organism is in a state of fluctuating equilibrium with others, modulated by the physical, chemical, and biological environment of the soil. Man's attempts to control plant pathogens in soil have often, consciously or unconsciously, been effective through altering microbial balance, even though the intent was to destroy or inhibit pathogens. Variation of a factor of the soil environment may change the balance and affect development of a plant pathogen. The effect may be to (1) stimulate antagonists in the microflora and reduce activity of the pathogen, (2) suppress or eliminate antagonists and increase pathogen activity, or (3) essentially destroy the soil microflora, so that the first organism to return luxuriates without competition. The ultimate problem in any successful soil treatment is the recontamination hazard; the more completely the soil microflora is destroyed, the greater is the risk. Furthermore, the effect of a given treatment on the total soil microflora is more important in root-disease control for long-term than short-term crops. Present efforts toward root-disease control, with disease incidence measuring effectiveness, will give way to studies in which success in disease control is analyzed in terms of the effect on the total microflora.

BAKER, RALPH, and CHARLIE MARTINSON. Colorado State University. *The Isolation of Fungi by Means of the Soil Microbiological Sampling Tube.* Perforated plastic soil microbiological sampling tubes were used to isolate certain fungi from the soil. Plant exudates were collected with a modified soil perfusion apparatus and added to water agar, potato dextrose agar, or potato dextrose agar modified with 0.067 gm. rose bengal per liter in the tubes. Radish exudates significantly increased the frequency of isolation of *Rhizoctonia praticola* in comparison to the same media without exudates. In contrast, tomato exudates increased the frequency of *Fusarium* spp. isolates. The addition of 100 parts per thousand pentachloronitrobenzene to soil was effective in reducing the invasion of tubes by *Rhizopus nigricans* and correspondingly increased the frequency of invasion by *Fusarium solani* f. *phaseoli.* Inoculum density was correlated with disease severity and frequency of invasion of the tubes in *R. praticola* and *F. solani* f. *phaseoli.* For example, correlations between damping-off incited by *R. praticola* and frequency of invasion of the tubes by the same fungus were between 0.85 and 0.96 in all experiments.

Baksay, Leona. Ferenczy Károly Museum, Szentendre, Budapest. *Cytotaxonomy, Chorology, and Phytocenology.* Our knowledge relating to vegetation is based on species. Our view concerning the range of a species depends considerably upon our taxonomic conception of the species in question. The taxonomic problems of the different species of relict and other associations can be solved more quickly and with greater success by cytological methods. Examples referred to here are: *Mercurialis perennis* with a chromosome number of $2n = 42$, *M. ovata* with $2n = 32$ chromosomes, and its polyploid *M. longistipes* with $2n = 64$ chromosomes; the latter is widely distributed in Central and Southern Europe. The conspecies *Chrysanthemum leucanthemum* s.l. has a polyploid series, which separates into four species differing also as to their ecological claims. A small endemism is *Festuca tatrae* with a chromosome number of $2n = 14$; its polyploid *F. amethystina* with $2n = 28$ chromosomes reached its maximum southern range – the Illyrian and Caucasian mountain regions – in the Würms III period and migrated back to Central Europe in post-glacial times. The leading species of Asplenio- and Seslerio-Festucion glaucae, *F. glauca* with $2n = 14$ chromosomes, is a montane, subalpine plant; its polyploid *F. pallens* with $2n = 28$ chromosomes lives in hilly regions. They arose at different times and in a different manner. The evaluation of character species, the classification of phytocenoses, must be effectuated by taking the cytological, genetic, and historical viewpoints into consideration. The common aim of taxonomy and phytocenology is to reveal and systematize correctly the evolutional process taking place in nature. Great importance should be attached to the chorological and ecological investigation of each species because the development of the vegetation, the succession of phytocenoses in space and time, can only be understood through their different components, through the evolution of species by the aid of cytological and genetic methods.

Bakshi, Trilochan S., and Robert T. Coupland. University of Saskatchewan. *An Anatomical Study of the Subterranean Organs of Euphorbia esula in Relation to Its Control.* Young roots of *Euphorbia esula* exhibit a structure similar to that of a typical dicotyledonous species. In older roots wood comprises as much as two-thirds of the total tissues. Phellogen originates in the inner two layers of cortex. Cork is several layers thick, and lenticles are of open type. Pericyclic meristem forms a continuous ring, any part of which may give rise to lateral organs. The primordia of lateral roots and shoots cannot be distinguished morphologically from each other until they have emerged from the parent organ. In the stems the lateral buds originate endogenously from the internodes but exogenously at the nodes. The subterranean organs of the species are supplied with simple, non-articulated, and branched laticifers. Almost all parenchyma cells, including the laticifers, are filled with starch grains. The significance of these anatomical features with respect to the control of the species is discussed.

Bald, J. G. University of California. *Distinction between Forms of Tobacco Mosaic Virus.* The extreme and almost continuous range of mosaic symptoms produced by different isolates of tobacco mosaic virus (TMV) eliminates them as criteria for distinguishing between strains. Biophysical and biochemical properties and a few host reactions are better criteria. They may be used with the selective capacity of host species to define ecological forms of TMV. Each of several host species widely infected with TMV contains 1 or 2 dominant forms of the virus with distinctive properties. The dominant form in tobacco is represented by U1 (Siegel and Wildman). *Nictotiana glauca* growing wild in California and elsewhere is commonly infected by the U5–U2 form. Isolates from California tomatoes have properties in common with tomato isolates in other countries, and are more nearly similar to the U5–U2 form than to U1. The TMV apparently dominant in tomato, and the Plantago, cucurbit, and cowpea strains appear to be distinct forms. Single lesion isolates of TMV may be altered symptomatically by the environment in which infected plants are grown, without altering biophysical properties or certain host reactions. Bawden has reported changes equivalent to conversion of one form of TMV into another by transfer to unrelated host species in a radically altered environment. Properties of TMV isolates from different host species do not fit the common belief that other forms of TMV are derived from the tobacco form (U1).

Baldwin, H. I. New Hampshire Forestry and Recreation Commission. *Distribution and Ecology of Pinus banksiana in New Hampshire.* A pine widely distributed in Canada and the Lake states of the United States, *Pinus banksiana,* occurs in New Hampshire in only four widely separated stations as outliers from the southern limit of its range. These are all on bare rock ledges, originally denuded by fire or landslide. Most of the trees are young and there is evidence that the communities are increasing in density and spreading in area. Habitats and associated species are similar at all stations. Hypotheses of the origin of the trees and the successional history are advanced.

Ball, Ernest. North Carolina State College. *A Time-Lapse Study of the Growth of the Shoot Apex of Lupinus albus.* The shoot apex was prepared by removing all leaves and all foliar primordia except the youngest one. The bud that was inoculated into the culture medium was approximately 10 mm. in length. The agar medium was contained in a Kelle flask that had a hole 25 mm. in diameter ground in the center of the top. After the bud was inoculated immediately beneath the hole, the hole was covered by a sterile, polished cover glass that was sealed in place by a silicone compound. Sterile conditions were maintained throughout the experiments. The cover glass was kept warm, in order to prevent condensation of droplets of moisture upon its lower surface, by a loop of resistance wire laid over it outside the field of the objective. Pictures were made with either a 6.5× or 11× Ultrepak objective with an appropriate ocular at intervals of 1, 2, or 3 minutes. During the observations, which lasted from 1.5 to 9 days for each bud, the surface cells of the sheet apex divided frequently with great rapidity. Apparently the divisions were most frequent between the periods of production of foliar primordia. No region of the shoot apex, as viewed from above, appeared to have the majority of divisions, nor was there any part of the apex that seemed to lack divisions.

Banks, Harlan P. Cornell University, Ithaca, New York. *The Stratigraphic Occurrence of Devonian Plants with Applications to Phylogeny.* Speciation requires time; stratigraphy provides data for studying speciation in Devonian plants. Present knowledge of fossils from New York and eastern Canada and of formations from the basal Middle Devonian Marcellus (Couvinnian) through the Chemung stage (Frasnian) of the Upper Devonian, emphasizes four major points: (1) that many Devonian genera have very long ranges (e.g., *Aneuro-*

phyton – Marcellus to Chemung); (2) that little morphological change is exhibited by species of these genera (e.g., *Aneurophyton Hallii* from the Marcellus and from the Naples group are alike in primary and secondary xylem characters); (3) that structurally complex genera showing well-defined characters of major groups of vascular plants are already established in Middle Devonian (e.g., Lycopsida: herbaceous, *Colpodexylon* (Marcellus) and arborescent, new genus (Skaneateles); Sphenopsida: *Prosseria* (Moscow); ferns: *Asteropteris* (Moscow); gymnosperm precursors: *Aneurophyton* (Marcellus), *Sphenoxylon* (Moscow), *Callixylon* (Geneseo)); (4) that a large and diverse group of ferns is present in Middle Devonian – *Schizopodium, Arachnoxylon, Reimannia, Iridopteris, Xenocladia, Asteropteris, Trimerophyton* plus two new genera. It is also significant that many predominantly Lower Devonian genera persist into Middle Devonian (e.g., *Zosterophyllum, Hostimella, Drepanophycus, Taeniocrada*). Continued emphasis on stratigraphy and on detailed comparisons of species indicate that vascular plants originated long before Devonian time.

Banks, Harlan P., F. M. Hueber, and M. W. Wilcox. Cornell University, Ithaca, New York. *Remarks on Devonian Ferns.* The gradual discovery of plant fossils in the Devonian that exhibit an anatomical organization indicative of affinities with the ferns has been impressive. The several genera already known are restricted in both geological and geographical distribution, and they are represented by few specimens. We hope to demonstrate that the fern population in Devonian was much more extensive. We have found new localities and new specimens of some genera, extended the stratigraphic range of several, and found several new plants. This list summarizes present information in fern petrifactions in New York. Upper Middle Devonian: *Reimannia aldenense* Arnold, 1935; *Arachnoxylon kopfi* (Arnold) Read, 1938; *Iridopteris eriensis* Arnold, 1940; **Asteropteris noveboratensis* Dawson, 1881; *Schizopodium mummi* Read, 1938; *new genus "A," *Xenocladia medullosina* Arnold, 1940. Lower Upper Devonian: **Reimannia aldenense*; **Arachnoxylon* n. sp.; **Asteropteris noveboracensis*; **Schizopodium davidi* Harris, 1929; *new genus "A," **Xenocladia medullosina; Cladoxylon dawsoni* (Dn.) Read, 1935; **Cladoxylon* n. sp.; **Clepsydropsis* n. sp. **branch* like those attached to *Cladoxylon radiatum*, **aphlebiae* with cladoxylalean affinity, *new genus "B." We conclude that there is now a sound basis for believing that well-established ferns of the cladoxylalean and coenopterid type existed from Middle Devonian onward. Undoubtedly, vascular plants had a long period of pre-Devonian evolution. (*Denotes new information.)

Banks, Harlan P. *See* Leclercq, Suzanne C. M.

Bannan, M. W. University of Toronto. *Some Factors Influencing Cell Size in Conifer Cambium.* During the growth of the first few years certain changes are observable in cambial behavior in conifers. The anticlinal divisions involved in cambial cell multiplication tend to decrease relative to radial increment, and the rate of gain of new initials falls off. Cell length gradually increases. In the peripheral growth of mature trees much variation exists from tree to tree. In some there is relative cambial stability, while in others anticlinal divisions follow in rapid sequence and there is continued replacement of old initials by new ones. As a rule cell length is somewhat less in vigorous than in slow growing trees. In fluted stems cell length is appreciably less in the grooves than in the neighboring convex sectors. No consistent differences in cell size have been detected between trees in wet and dry sites.

BANNAN, M. W. University of Toronto. *The Vascular Cambium in Conifers.* In the conifers the generative zone between xylem and phloem consists of a uniseriate initiating layer and derived tissue mother cells. Periclinal divisions occur throughout the cambial zone, but during the period of maximum growth greatest activity occurs among the xylem mother cells. By way of contrast, anticlinal divisions, which are involved in increasing girth of the cambium, take place mostly in the initiating layer. The rate of anticlinal division is generally such as to cause overproduction and competition among the new-formed initials. Usually the initials which are longest and have the largest areas of ray contact persist and the shorter maturate or become reduced to ray initials.

BARANOV, P. A. Academy of Sciences, Leningrad. *The Progress of Investigations in Plant Fertilization, Apomixis, and Polyembryony in the U.S.S.R.* Russian scientists have made an important contribution to the knowledge of the fertilization in plants. The discovery by I. N. Gorozhankin of the release of the spermium from the pollen tube and the classical discovery of the double fertilization by S. G. Navashin must be mentioned in the first place among the Russian discoveries. The most characteristic feature of the recent investigations in plant embryology in the Soviet Union is that they are based on the evolutionary principle. The rôle of cytology in the solution of various embryological problems has become much more conspicuous. This penetration of cytology into the embryology of plants has paved the way for the "mitotic hypothesis" advanced by H. N. Gerassimova-Navashina. This hypothesis explains the origin of double fertilization and its mechanism, and elucidates the process of fertilization as a whole; it also suggests certain new ways of investigating apomixis. The attention of Soviet plant embryologists is drawn to cytological and anatomical investigations of the relationships between developing reproductive elements and surrounding tissues. Along with detailed cytomorphological analysis, the methods of cytochemistry and cytophysiology are used in the solution of this problem, as well as the study *in vivo* of generative processes. A type of embryonic development new for angiosperms (hitherto known only in gymnosperms) characterized by the existence of the coenocytic phase in the beginning of embryogenesis, discovered by M. S. Yakovlev in Paeonia, is of great interest. This discovery affords some extremely valuable new evidence contributing to the solution of the problem of the origin of angiosperms. The attention of the Soviet embryologists is also concentrated on the problem of the origin of polyembryony both in nature and in experiment. On the basis of the results of investigations devoted to this problem, attempts are being made to elaborate a classification of the types of polyembryony. Among the works of Soviet botanists working on the problems outlined in this paper, the investigations of E. A. Britikov, H. N. Gerassimova-Navashina, K. J. Kostriukova, J. S. Modilevsky, M. S. Navashin, V. A. Poddubnaya-Arnoldi, E. M. Polyakov, N. V. Zinger, and M. S. Yakovlev must be mentioned.

BARINOW, G. W. *See* RATNER, E. J.

Barker, W. George. Vining C. Dunlap Laboratories, Tela Railroad Co., La Lima, Honduras. *Studies in Propagating the Banana Plant.* The commercial banana is seed sterile and is propagated by the development of lateral buds that spiral about the rhizome top and the true stem. A system of maximum multiplication of this material has been developed that has yielded as many as 25 plants from a single original plant within 11 months. This enables the rapid propagation of new varieties, sports, etc., and is of use in disease control. The method has been used successfully on 11 banana varieties and in commercial practice. Since such techniques require the use of small planting-pieces the relationship of initial planted weight, germination, and subsequent foliar growth has been worked out for Honduras. In conjunction with these studies, a phenomenon has been observed in 20 known instances where a fruit has appeared on a very immature plant. Typically, fruit is formed after more than 40 leaves and some 7 months after planting in Honduras. The theoretical implications of the early fruited suckers are explored.

Barlow, H. W. B., and C. R. Hancock. East Malling Research Station, England. *The Experimental Modification of Axillary Branch Form.* Lateral buds on stoolbed shoots of a vegetatively propagated apple rootstock were induced to grow out into branches by decapitating the main shoot at various positions from the tip (within the terminal leaf cluster) to near the base, or by removing leaves in or near the terminal cluster. The treatments profoundly affected the form of the induced branch system: that is, the number of buds induced to grow out, the length of the branches, their angle with the main stem, and the size of their leaves. The phyllary structures displayed at the base of the branch indicated the stage of development of the lateral bud from which it arose: on branches emerging low on the main stem there were four to five bud-scales merging by transitional forms into normal leaves, whereas buds induced to grow from young regions of the shoot showed no scales or transitional organs – instead, there were two opposite crescentic leaf-like structures at the extreme base followed by a normal leaf. Such crescentic organs rarely occur naturally. The internodes towards the base of the branch vary in length with the kind of organ present.

Barnett, H. L. West Virginia University. *Nutritional Factors Affecting Morphogenesis of Some Pyrenomycetes.* The morphology of a fungus is a reflection of its metabolic activities. Differences in morphology, fruiting, and sporulation may be initiated by differences in source, concentration, and ratios of the essential nutrients in the substrate. Metabolic activities also may be influenced greatly by pH and environmental factors. Special morphogenic characters not related to reproduction may be initiated by specific chemicals, but no specific sporulation substance is known. Fruiting and sporulation ordinarily are correlated with changes in concentrations and ratios of the same nutrients required for vegetative growth. Particularly is this true of a local or general reduction in carbon concentration. Biotin deficiency results in abortive asci and ascospores, as well as reduced vegetative growth. Greater amounts of thiamine are required for fruiting in high concentrations of carbon than in low concentrations. Sorbose causes excessive branching and a compact colony of restricted radial growth. The size of spores may be influenced by the concentration of carbon and nitrogen. New techniques are needed for the study of the effects of specific nutrients in changing concentrations during growth and development of the fungi and the effects of nutrients at constant concentrations.

Barrett, James T. University of California. *Isolation, Culture, and Host Relation of the Phycomycetoid Vesicular-arbuscular Mycorrhizal Endophyte Rhizophagus.* Isolation, purification, and culture of the widely occurring vesicular-arbuscular type of root endophyte have been accomplished several times. Synthesis of mycorrhizal relationship was established in host species. In all of the eleven isolations established to date growth was first secured on small fragments of boiled hemp-seed cotyledons, which were submerged onto extra-radical mycelium adjacent, and often attached, to mycorrhizal roots. Growth of the endophyte appeared, if at all, only after a 4- to 6-week period. After identification by the highly refractive fat-filled vesicles, the purification process began which was usually long and challenging and not always successful. No culture of the endophyte has been established from infected root tissue. Culturally the isolates show marked similarities in possessing non-septate mycelium and vesicles in varying numbers, yet differences exist in character and rate of mycelial growth and response to various media tested. Aerial mycelium is generally absent. Synthesis experiments suggest that specificity does not exist and that the morphological relationship of the fungus to the host plant remains the same irrespective of the origin of the isolate used. Thus, an isolate that produces a thamniscophage relation on one plant produces a tolypophage type on another.

Barthelmess, A. Universität München. *Permanenz von Spindelelementen bei bipolarer und multipolarer Mitose.* Mit niederen einwertigen gesättigten Alkoholen lassen sich in sehr grosser Zahl multipolare Mitosen erzeugen. Die dabei zu beobachtende Anordnung der Chromosomengruppen ist jedoch nach den gegenwärtig in Diskussion stehenden Hypothesen über die Mitosemechanik nicht oder nur mit Hilfsannahmen zu erklären. Da auch eine Reihe von Teilprozessen der normalen Mitose noch immer schwer verständlich ist, wird ein anderer Deutungsversuch zur Diskussion gestellt, der sowohl auf die normalen, wie auf die meisten Typen künstlich aberranter Mitosen anwendbar ist. Die Grundgedanken sind folgende. (1) Das Centromer jedes Chromosoms ist von der Telophase über die Interphase bis zur Metaphase durch 2 Fasern mit—normalerweise—zwei einander gegenüberliegenden Stellen der Kernmembran, den Polfeldern, dauernd verbunden. (2) Durch Ausgleich von Spannungsunterschieden zwischen den beiden Fasern gelegentlich des Umbaus der Kernmembran wird das Centromer aus der Prophase- in die Metaphaselage transportiert. (3) Bei der Reduplikation jedes Chromosoms wird zwischen den Centromeren der Chromatiden eine neue Verbindungsfaser angelegt und in der Ana-Telophase expandiert. An der Durchtrittsstelle durch die neue Zellwand und Kernwand wird diese Faser fixiert und bleibt von nun an als Struktur erhalten. (4) Die im Lichtmikroskop sichtbare Spindel besteht aus diesen permanenten Fasern und einem in Kontakt mit ihnen auf- und abgebauten Körper mit mechanischer Hilfsfunktion. (5) Die multipolare Mitose entsteht aus der bipolaren durch Spaltung eines oder mehrerer Polfelder gelegentlich des mitotischen Umbaus der Kernmembran. (6) Mehrkernige Zellen mit hypoploiden Kernen entstehen nur dann, wenn nach partiell geordneter Metaphaselage aktive Chromatidtrennung mit Bildung einer genügend expandierten Verbindungsfaser erfolgt, da von Stellen dieser Faser die neue Zellwand und Kernwand induziert wird. Andernfalls entsteht ein polyploides Synkaryon.

BARTNICKI-GARCIA, S., and WALTER J. NICKERSON. Rutgers University, New Jersey. *The Yeast-like Form of Mucor rouxii.* Cultures of *Mucor rouxii* were found to grow in a purely yeast-like form if incubated under high CO_2 tension. The growth consisted of spherical cells (10-40 in diameter), usually with two to four buds per cell, but ten or more buds per cell were not uncommonly found. On solid media, typical yeast-like colonies developed under high CO_2 tension. When subcultured in the presence of air, the yeast-like cells readily reverted to a hyphal growth form. To maintain cells in the yeast-like form, an atmosphere of 100 per cent CO_2 was necessary. Under anaerobic conditions (nitrogen), a concentration of 25 to 30 per cent CO_2 was sufficient to obtain a purely yeast-like development. Anaerobic cultures in the absence of CO_2 developed a mycelial form, with very few yeast-like structures. Under acidic conditions (pH 2 to 3), and in the absence of CO_2, structures somewhat resembling yeast-like cells were obtained. They differed, however, from the CO_2-induced yeast-like form in having a distorted spherical shape, a granular cytoplasm, and fragile cell walls. Both the mycelial form grown under nitrogen, and the yeast-like form grown under CO_2, fermented glucose with the production of similar quantities of ethanol, and showed equal efficiency in the utilization of glucose for cellular synthesis. Both growth forms required thiamin and niacin, whereas no vitamin requirement was evident when the fungus was grown under aerobic conditions. In an effort to define the biochemical locus through which the morphogenetic effect of high CO_2 tension may be operative, the effect of CO_2 tension on fixation of $^{14}CO_2$ by both mycelial and yeast-like growth forms has been investigated, and the effect of high CO_2 tension on enzymatic decarboxylation reactions has been explored.

BARTOO, HARRIETTE V. (KRICK). Western Michigan University. *Plant Fossils from the Shales of Berea, Ohio.* This collection, consisting of about 45 specimens of plant materials, comes from the Berea shale, a dark, fossiliferous shale from 15 to 50 feet thick which overlays the Berea sandstone or "grit" in the old Berea quarry, now no longer in operation. When it was active, collectors such as William Clark, Jay Terrell, Herman Herzer, and A. A. Wright made splendid contributions to science by recovering and describing the fossil fish found there; but, although descriptions mention abundant "land plant remains," no descriptive account of them seems to have been published. The collection is housed by the Geology Department of Oberlin College, Oberlin, Ohio. The collector is unknown. The most spectacular material is that showing cones or portions of cones, several of which are attached to stems of lycopodiaceous affinity. Several branching stems of this same type, some decorticated, are also present. The only leaves are very short, simple ones, arranged in a spiral arrangement on larger stems. Miscellaneous smaller portions of Calamites stem, Cordiates leaf, and large fern-like stipes are also present. A strong resemblance to Dawson's material described as *Lepidodendron corrugatum* and *Cyclopteris acadica* from the Horton shales of Nova Scotia is noted. Marine shells are abundant in some pieces.

BASSHAM, A. *See* PARK, R. B., *et al.*

BATJER, L. P. *See* WOODBRIDGE, C. G., *et al.*

BATTAGLIA, EMILIO. Università, Trieste, Italy. *New Types of Embryo-sac Development in Scilla autumnalis* (*Liliaceae*). The embryo-sac development of *Scilla autumnalis* is usually characterized by the occurrence of the 8-nucleate *Polygonum* (normal) type (Battaglia, 1959). During cytological examination of tetraploid populations, two plants have been observed, showing 16-nucleate (rarely 14-, 12-, and 10-nucleate) mature embryo sacs. Preliminary studies revealed the following new type (and subtypes) of development for all flowers of the two plants. (*a*) The meiosis takes place regularly and a row of four uninucleate megaspores is formed. (*b*) No megaspore degenerates and partition walls begin to be reabsorbed and the four megaspores fuse together. The post-meiotic stages show variable features, for instance: (1) three megaspores having respectively two, one, and one nuclei; (2) two megaspores having two nuclei each, or three and one respectively; (3) four megaspores more or less fused together; (4) one 4-nucleate megaspore. The meiosis, the dissolution of the walls, and the fusion of megaspores will be investigated more carefully in future after collection of new material. (*c*) At the end of the first post-meiotic mitosis the embryo sac shows usually an 8-nucleate stage characterized by a variable polarization of the nuclei. The more common polarization is represented by the nuclear disposition $3 + 5$, less common is the polarization $2 + 4 + 2$, and with low frequencies the polarizations $4 + 4$ and $5 + 3$ can occur. (*d*) The second post-meiotic mitosis (and last division of the embryo-sac development) gives rise to a 16-nucleate stage. (*e*) The organization of the mature embryo sac presents a great variation in that the micropylar region is characterized by supernumerary synergids or eggs in more than 60 per cent of all cases. For instance, the following types of embryo-sac organization have been observed (S = synergid, E = egg, PN = polar nucleus, A = antipodal cell); 2S+E+2PN+11A; 3S+2E+2PN+9A; 4S+E+2PN+9A; 5S+E+2PN+8A; 7S+2E+2PN+5A. (*f*) Other subtypes of development, for instance 14-, 12-, and 10-nucleate embryo sac and infrequent abnormalities due to nuclear fusion in post-meiotic stages, have been also found. The cytological study of these is now in progress. (*g*) We wish to point out that the above-mentioned type and subtypes of embryo-sac development represent the normal development for the two plants which we consider an embryological mutant. No ovule of these two plants develops according to the 8-nucleate *Polygonum* type. (*h*) The mechanism of wall dissolution seems similar to that described for *Convallaria majalis* by Stenar (1941). Only the walls formed at the end of the second meiotic division are laid down; thus two binucleate megaspores arise. The chalazal megaspore functions as initial cell of the embryo sac and the development is actually bisporic as in the 8-nucleate *Allium* type. (*i*) In the literature only one case has been reported in which all walls between megaspores are dissolved and the four megaspores fuse together, more precisely for one partially apomictic individual of *Leontodon hispidus* (*Leontodon hispidus*, Pflanze, 1931; cf. Bergman, 1935). Here the partition walls thicken and become gelatinous before their slow dissolution. The last stage in development is fundamentally 8-nucleate and shows regularly two synergids and one egg (18 cases out of 25 examined). Abnormal embryo sacs 9-nucleate (two cases), 11- to 12-nucleate (one case each) and 16-nucleate stages (two cases) were also observed, always showing two synergids and one egg. The type of development described for our embryological mutant of *Scilla autumnalis* differs from the *Leontodon* type in that it is fundamentally 16-nucleate and characterized by supernumerary synergids.

Baxter, Dow V., and John T. Middleton. University of Michigan and University of California. *Geo-fungi in Forest Succession Following Retreat of Alaskan Glaciers.* The incidence of different species of fungi varies greatly at different stages in the development of a forest. A study was made of the occurrence of fungi in and about roots of trees that appear at various steps during forest succession in Alaska and especially following the retreat of the glaciers. Fibrous roots were collected at numerous developmental periods from a number of tree species in a variety of vegetative types. These types included those in which trees first appeared after recession of coastal glaciers, matured and overmatured littoral forest stands, coastal muskegs, interior permafrost, and those of the interior upland non-permafrost. Root samples were taken in August and September in the area of maximum root density and from the following trees: *Alnus sinuata, Betula papyrifera, Chamaecyparis nootkatensis, Juniperus* sp., *Picea glauca, P.* x *lutzii, P. mariana, P. sitchensis, Pinus contorta, Populus balsamifera, Salix* spp., *Tsuga heterophylla*, and *T. mertensiana.* Individual roots were selected from those removed from the soil mass and cut into approximately 40 mm. lengths. The soil from some of these root pieces was removed by washing thoroughly in water, and then dipping the root in alcohol, igniting, and plunging it into 18 by 148 mm. culture tubes holding 15 ml. plain water agar with small bits of propylene oxide-sterilized alfalfa, bean, or pea straw, or corn seed. Among the numerous fungi from the total of 487 stab cultures made during the past three years are: *Cunninghamella, Fusarium solani, F. oxysporum, Melanospora, Mortierella, Phytophthora* spp., *P. cactorum, Pythium* spp., *P. irregulare, Rhizoctonia solani.*

Baxter, Robert W. University of Kansas. *Sporocarpon and Allied Genera from the American Pennsylvanian.* Specimens of the genera *Sporocarpon* (Williamson) Hutchinson and *Dubiocarpon* Hutchinson are described from the middle Pennsylvanian of the central United States. *Sporocarpon spinatus* and *Dubiocarpon major* are described as new species. *Sporocarpon cellulosum* and *Sporocarpon asteroides* are described for the first time from American coal ball material.

Bayley, S. T., and George Setterfield. National Research Council of Canada. *Changes in the Microsomal Components of Plant Cells in Relation to Growth.* Structural changes in the cytoplasm accompanying the development and maturation of plant cells have been examined in oat coleoptiles of different ages and in the stems of young pea seedlings, all grown in the dark. Electron microscopy of thin sections revealed an increase in the extent of the lamellar and vesicular systems during development of the cell and this was accompanied by a dilution of the ribonucleoprotein particles. Sedimentation studies of cell homogenates showed that the number of ribonucleoprotein particles per cell remained constant during cell growth but became negligible as the cell reached senescence. Electron microscopy suggested that while in old cells the lamellar and vesicular systems are able to withstand homogenization of the cell, in the developing cell they are disrupted.

BAYLEY, S. T. *See* SETTERFIELD, GEORGE

BAYLIS, G. T. S. University of Otago, Dunedin, New Zealand. *Effect of Vesicular-arbuscular Mycorrhiza on Growth of Griselinia littoralis* (*Cornaceae*). *Griselinia littoralis* is normally heavily infected by a vesicular-arbuscular phycomycete which occurs less abundantly in numerous other New Zealand trees. It has not been induced to make more than transient growth into agar, but has survived in soil kept moist for 26 months. In partially sterilized soil in which ectotrophic mycorrhiza was necessary for sustained growth of *Pinus radiata*, development of vesicular-arbuscular mycorrhiza proved necessary for sustained growth of *Griselinia*, but a non-mycotrophic tree *Myrsine australis* grew steadily. The inoculum used to establish mycorrhiza upon *Griselinia* did not stimulate its growth when mycorrhiza was not formed; it produced no symbiotic infection in *Pinus* and only traces of it in *Myrsine*, and it depressed the growth of both these species. Chemical analyses indicated that the main factor limiting growth in these experiments was availability of phosphorus. Mycorrhiza of *Griselinia* and *Pinus* produced closely comparable increases in phosphorus uptake.

BAZHANOVA, N. V. *See* SAPOZHNIKOV, D. I., *et al.*

BEALS, H. O., and W. N. MELHORN. Purdue University, Indiana. *Application of an Abrasive Paper Technique in Preparing Transverse Sections of Pleistocene Wood for Microscopic Study.* Difficult transverse sections of Pleistocene wood are prepared for microscopic examination by use of an abrasive paper technique developed at Purdue University. These sections, of any length and width and a thickness of 10 to 25 microns, are made by impregnating a thin transverse slice of wood with a modified rosin ester and grinding on successively finer grades of abrasive paper until the proper thickness is reached. Longitudinal sections may also be prepared by this technique with somewhat less satisfactory results.

BECKING, RUDOLF W. Alabama Polytechnic Institute. *Quantitative Evaluation of Plant Communities and the IBM Codification of Phytosociological Data.* In the Zürich-Montpellier School of Phytosociology, species fidelity is determined from presence, abundance-cover, and vitality of individual species. These values are obtained by observation and ocular estimation. Calculations for relative faithful presence, characteristic abundance-cover degree, characteristic vitality, and characteristic sociability promise to offer numerical criteria for the assessment of the fidelity value of each constituent species. The characteristic species composition of communities has to be extracted from the assemblage of all the species. IBM machine tabulations will greatly facilitate such numerical comparisons and permit broader use of statistical methods. Species presence is considered to be the primary criterion for numerical evaluation of species fidelity; abundance-cover degree and vitality are of secondary importance. Theoretically, species fidelity is determined from the ratio of the common area in species and community range. Since neither the absolute areal extent of a species' range nor that of a plant community can be determined, faithful presence, calculated from the available series of vegetation plots, is substituted. With more extensive sampling to cover large regions and include extremes in species and community range, faithful presence will become a more objective measure. Classification (ordination) of plant communities is based upon acceptance of discontinuity. A random vegetation pattern is exceptional; transgressions between communities are common phenomena. Introduction of statistical evaluations into phytosociology will reduce bias and improve objectivity of this classification.

Beer, Michael. The Johns Hopkins University, Baltimore. *Fine Structure of Phloem of Cucurbit as Revealed by the Electron Microscope.* An electron microscope study of the phloem of cucurbit has been carried out on cells at different levels of development. In mature sieve tubes, the sieve plates appear to be open with no indication of membranes across them. Cytoplasm penetrates through the sieve pores. The slime bodies are granular in structure and are bounded by a double membrane. The mature sieve tubes contain no mitochondria, endoplasmic reticulum, or nucleus, but contain some vesicles. The companion cells have a nucleus and are densely packed with the cytoplasmic particles (now recognized as being intimately linked with metabolism), mitochondria, and microsomes, but not starch granules or chloroplasts. The plasmadesmata between the companion cells and the sieve tubes are highly developed. The implications of these findings will be discussed.

Beetle, Alan A. University of Wyoming. *Distribution as a Key to Age and Origin of Grasses.* The vegetation of the earth should be recognized as a geologic feature. Properly interpreted, the distributions of living plants may elucidate the history of vegetation back to the earliest Cretaceous. Then the Tethys Sea by dividing Old World climates established the striking contrasts which occur between the panicoid and festucoid types of grasses, the first being predominately tropical, the second predominately temperate. In more recent geologic history more detailed information leads to important conclusions concerning the time of distribution of grasses. For example, Wyoming is divided from northwest to southeast by the Continental Divide. In south-central Wyoming there is a gap in the Continental Divide where the usually high crest dips to barely 7,000 ft. elevation. The shortgrass plants to the east (e.g., *Buchloe dactyloides* and *Bouteloua gracilis*) respect this gap and do not pour through. The great basin plants to the west (e.g., *Agropyron smithii* and *Oryzopsis hymenoides*) do not respect this gap and pour through to a considerable enlargement of their natural ranges. The difference appears to be due to variations in age and origin of the grass species and the floras they represent. Further examples of this nature will be presented.

Beevers, H. *See* Yamamoto, Y.

Beevers, Harry. Purdue University, Lafayette, Indiana. *Utilization of Hexoses in Respiration.* Hexose is the primary respiratory substrate in plants. The bulk of useful energy production comes from the controlled oxidation of coenzymes which are reduced by intermediates derived from hexose. A major pathway by which such intermediates are produced is the Embden-Meyerhof-Parnas reaction sequence to pyruvate and the tricarboxylic acid cycle. In the last ten years, enzyme systems have been discovered which can catalyze the oxidation of hexose by an alternative route, the pentose phosphate pathway. Experiments with various plant tissues indicate that such a pathway contributes to hexose oxidation *in vivo.* The extent of this participation varies from one tissue to another. The relative contributions of the two major pathways of hexose breakdown in a given tissue can be experimentally modified. A third pathway of hexose oxidation, by way of uridine derivatives to glucuronate, is probably of minor respiratory significance. Tracer experiments show that not all of the intermediates produced in the above sequences are destined for immediate oxidation; utilization in synthetic events causes diversion from the main pathways. The extent of such drainage depends on the metabolic status of the tissue, but it is clear that the complete conversion to CO_2 of all of the carbon atoms of a hexose unit which has entered a respiratory sequence is the exception rather than the rule.

BELJDENKOVA, A. F., and I. N. KONOVALOV. Academy of Sciences, Moscow. *An Investigation of the Physiological Effect of Growth Substances on Plants.* The object of this investigation was to study the effect of gibberellin and of 3-indoleacetic acid (heteroauxin) on some physiological characteristics in plants. The plants treated with gibberellin only were *Digitalis purpurea* L., *Legousia speculum-veneris* L., *Beta vulgaris* L., *Perilla ocymoides* L., and *Setaria italica* L. *Lycopersicon esculentum* Mill. was treated with heteroauxin only. Gibberellin was applied as 0.02 per cent water solution to the growing points of the apical shoots, one drop a day, during one month. Heteroauxin was applied either to germinating seeds or, by spraying at fifteen-day intervals, during the early developmental stages (altogether three sprayings). The following effects of gibberellin and heteroauxin have been observed. (1) More intense growth: the effect of gibberellin was especially conspicuous (among the gibberellin-treated plants it was the most pronounced in *P. ocymoides*); the shape of leaves was also changed by gibberellin. In particular, the elongation of both leaf-blades and petioles was observed in all the treated plants. (2) Gibberellin accelerated the development of long-day plants, especially of *B. vulgaris* and *D. purpurea*. In the treated plants generative shoots developed in the first year of their life, while in the untreated plants they were usually formed only in the second year. (3) The chlorophyll content in leaves was never reduced by gibberellin treatment. In some individual plants (in all the species studied), it was increased to values exceeding by 20 to 30 per cent those in control plants. (4) An increase in the content of water-soluble carbohydrates was observed in all the plants treated either with gibberellin or with heteroauxin. (5) An increase in the intensity of the oxidation-reduction processes was observed in all the treated plants. In heteroauxin-treated plants it was more conspicuous; in particular, the intensity of respiration was increased as well as the content of reduced ascorbic acid at certain developmental stages and of oxidized ascorbic acid at other stages. Increased activity of oxidizing ferments was also observed.

BELL, W. D., L. BOGORAD, and W. J. MCILRATH. University of Chicago. *Studies of Iron Metabolism in Yellow-stripe Maize Mutants (ys_1).* Maize plants homozygous for the gene ys_1 develop leaves which have yellow stripes alternating with green stripes when grown under field conditions. We have reported (Bot. Gaz. *120:* 36, 1958) that ys_1 (yellow-stripe) plants develop uniformly green leaves when supplied sufficient ferrous iron. This can be achieved either by growing the plants in nutrient culture or by spraying plants in the field. Heterozygous ys_1 plants green equally well when supplied a given level of either ferrous or ferric versenate. Homozygous recessive plants, however, respond distinctly differently to the same level of the two forms of iron. Two types of studies have been conducted to attempt to determine the site of the metabolic differences between the heterozygous and homozygous recessive plants. Ferrous sulfate or ferric chloride, at iron levels of 10 p.p.m., have been found to be equally effective in promoting greening of excised leaf segments of phenotypically yellow-striped ys_1 plants. The rate of uptake of ferrous and ferric ions by roots of intact maize plants has been investigated using Fe^{59}. Differences in the rate of uptake of the two ions were observed in both the homozygous recessive and the heterozygous plants.

Beno, D. W. *See* Allen, O. N., *et al.*

Benson, A. A., J. F. G. M. Wintermans, R. Wiser, M. Lepage, J. A. Miller, and R. A. Ferrari. Pennsylvania State University. *The Lipids of Chloroplasts.* Green plant tissues and particularly chloroplasts contain highest concentrations of the three major galactolipids, galactosyl monoglyceride, galactosylgalactosyl monoglyceride and the plant sulfolipid, 6-sulfato-galactosyl monoglyceride, and phosphatidyl glycerol. These occur in animal and non-photosynthetic plant tissues but only in low concentrations. The concentration of the diglycerophosphate lipid, phosphatidyl glycerol, is generally highest of the phosphatides and it is exceeded several-fold by the sulfolipid and other galactolipids. The important metabolic role of these lipids is demonstrated by their rapid C^{14} turnover. The lipid products of brief steady-state photosynthesis in $C^{14}O_2$ by *Chlorella* contain an appreciable fraction of the fixed radiocarbon. The galactolipids and the phosphatidyl glycerols become labeled most rapidly. Their rates of C^{14} labeling greatly exceed those of the phosphatides, lecithin and cephalin. Acid hydrolysis of the galactolipids revealed that the galactose moiety was most rapidly synthesized. The glycerophosphate available in the phosphatidyl glycerol could well serve as a source of triose phosphate and DPNH for hexose synthesis. Its concentration within spinach chloroplasts exceeds that of the rest of the cell. The high concentration, 10^{-2} M, of chloroplast lipids of these types suggests structural and metabolic functions in the photosynthetic apparatus.

Benson, N. R. *See* Woodbridge, C. G., *et al.*

Berbee, J. G. University of Wisconsin. *Birch Dieback: Present Status and Future Needs.* Evidence has been presented which suggests that a primary pathogen is involved in birch dieback. Nonetheless, the secondary effects of adverse environment and of the bronze birch borer are important. The deterioration of stands following physical disturbances, such as selective cutting, demonstrates that birch will not tolerate sudden environmental changes. The bronze birch borer has proven an important secondary invader. Many features of birch dieback, including symptoms, spread, and range of the disease, indicate the presence of a virus. Symptoms of a systemic virus disease which has been transmitted experimentally from typically diseased trees resembled the early stages of birch dieback, but the severity of this disease in nature has not been determined. However, an infectious disease which weakens scattered trees in birch stands could have devastating effects. Weakened trees often are killed by the bronze birch borer. The evidence indicates that resultant openings in the stand would encourage the deterioration of the remaining non-infected trees. The role of viruses and other biotic agents, including pathogenic fungi and nematodes, requires further clarification. More critical information also is needed on the physiology and ecology of birch. Future research should stress correlations of various phases of the birch dieback complex.

Bergersen, F. J., Commonwealth Scientific and Industrial Research Organization, Australia; P. W. Wilson and R. H. Burris, University of Wisconsin. *Biochemical Studies on Soybean Nodules.* Electron micrographs of thin sections of soybean root nodules reveal that the bacteroids are enclosed in groups within membrane envelopes similar in structure to and probably ultimately derived from the host protoplast membrane. There is some evidence that hemoglobin is located within these envelopes. Fractionation of soybean nodules which have been exposed to N_215 for short periods showed that the bacteroid fraction was not labeled until exposure exceeded one hour. The label appeared after ten minutes in the acid-soluble material extracted from the fraction-containing membrane envelopes and bacteroid cell-wall material, and thereafter rose with time in the centrifugal supernatant. Spectrophotometric studies of soybean nodule extracts have confirmed the specificity of the oxidation, in the presence of N_2, of hemoglobin in the extract. Since bacteroids are capable of reducing oxidized hemoglobin, possibly the pigment functions as an extracellular link in hydrogen transfer between the bacteroid and the N_2 fixing site. The root nodules of soybeans and peas evolve H_2 and catalyze an exchange reaction yielding HD from D_2 and endogenous donors of H. N_2 and N_2O inhibit the evolution of H_2, but CO has little effect. The exchange reaction is activated by N_2 and inhibited by N_2O or CO. These observations suggest a close relationship in the metabolism of N_2 and H_2 in nodules.

Bertsch, Walter F. Yale University. *Far-red Reversibility of Blue Light Effects in Etiolation.* Plant growth responses controlled by the red, far-red reversible system are in general only slightly affected by blue light. This low effectiveness of blue light could be due either to lack of absorption of blue wavelengths by the effective pigments, or to approximately equal absorption of blue light by the two oppositely acting pigment forms. In etiolated pea-epicotyl sections, uncontaminated blue and red light both inhibit growth, and both effects are reversible by far-red irradiation. The similarity of action of red and blue light indicates that at least the red-absorbing photomorphogenic pigment also absorbs blue light. Extreme apical sections 5 mm. long will double their length in 50 hours when incubated in a 0.02 *M*, pH 6.1 phosphate buffer medium containing 2% sucrose and 2×10^{-5} *M* $CoCl_2$. Of this growth, 60% is induced by the inclusion of cobaltous ion and sucrose in the medium. Red (6600 Å, 190 ergs/cm.^{2}/sec., 2 min.) and blue (4500 Å, 150 ergs/cm.^{2}/sec., 30 min.) irradiation inhibit growth induced by cobaltous ion and sucrose, but do not inhibit growth in buffer alone or growth induced by inclusion of 3-indoleacetic acid or gibberellic acid in the medium.

Beschel, Roland E. Mount Allison University, New Brunswick. *Glacier-foreland Succession in West Greenland.* Areas exposed by fifteen retreating glaciers since the various hypothermal advances could be dated by means of the growth rates of crustaceous epipetric lichens and also, for the last 200 years, by means of the speed of growth of plant cushions and by counting growth rings of willow stems. The soil-forming vegetation reaches maturity on more stable ground in about 300 years in the humid coastal region and the arid hinterland alike. The first pioneer plants are the same in most forelands. Open pioneer communities differ with age more and more between coast and interior in their species composition, but the number of species increases in an identical sigmoidal pattern and remains lower only at high altitudes. It may be higher when competition increases than in the various climax associations, indicating a positive edge effect in time. The final amount in the oldest foreland zones depends on the variety of habitats present. Rocks are colonized later than sand and loam. The epipetric vegetation climaxes after 250 years on the foggy coast and much later in the dry hinterlands. The slow-growing *Rhizocarpon* spp. reach their maximum diameters probably after 1,500 to 4,500 years respectively. South-exposed surfaces may remain bare in the interior.

BEST, RUPERT J. Waite Agricultural Research Institute, Adelaide, Australia. *Exchange of Determinants between Strains of Tomato Spotted Wilt Virus.* During the past 16 years a number of naturally occurring strains have been characterized by diagnostic symptoms as markers and were found to "breed true." Although chemical and scrological markers are not yet available the biological properties as expressed in tissue specificity and symptomatology are so definite that useful information can be obtained through these alone. When two strains (A and E) were inoculated simultaneously onto the same plants, some new strains were recovered from the mixedly infected plants. The new strains have been isolated by limit dilution technique from single local lesions. They differ from the originals, but each combines some of the markers of each of the parents. If A, B, C, and D represent genetic markers present and a, b, c, d denote their absence then the two parents and two recombinants isolated may be represented as follows: parent $A = ABcd$; parent $E = abCD$; recombinant $1 = aBCd$; recombinant $2 = abCd$. Both new strains have been isolated from a number of different plants in the same experiment and in another experiment repeated some months later. Recombinant 1 has been isolated not only from mixedly infected tomato plants but from the systemically invaded leaves of *Nicotania glutinosa* plants, a host which only one of the "parents" invades systemically.

BHARUCHA, F. R. University of Damascus. *Study of the Xerothermic Index Values of Syria, U.A.R.* In these times of the rapid economic development due to the ever increasing growth of the world population, all the possible economic resources of the world should be studied. One of the ways of improving the world's food supply is to study the natural vegetation of a country in relation to its environment and make a vegetation map which reflects clearly the ecological conditions in relation to the vegetation. Many attempts to do so have been made since the end of the nineteenth century, but none of them has proved totally satisfactory. The most recent attempt was made by H. Gaussen who has produced ecological maps which present both the real vegetation and the permanent ecological conditions. The choice of the scale depends upon the proposed use of the map and the amount and kind of knowledge about the country which is available. Following Gaussen's system, an ecological map of Syria, U.A.R., has been prepared. For this study, meteorological data from nine Syrian stations, namely, Damascus, Kamischlé, Aleppo, Jableh, Hama, Homs, Deir-ez-zor, Palmyra, and Fiq, were obtained from the Syrian Meteorological Station and the xerothermic indices were calculated. The results of this study are presented in this paper.

BIALE, JACOB B., and ROY E. YOUNG. University of California. *Recent Studies on Mitochondria from Fruits.* The studies on fruit mitochondria progressed along two lines: (*a*) biochemical characterization and (*b*) relation of activity to maturity and ripening. In the avocado the operation of the Krebs cycle was substantiated by studies of oxidation, inhibition, and product formation. Oxalacetate effects on pyruvate oxidation were ascribed to a coupled reaction which produced citrate and malate. Inhibition of succinate oxidation by oxalacetate was enhanced by calcium and reversed by magnesium and adenosine triphosphate (ATP) (Avron and Biale). The presence of cytochrome c in the particles, the operation of the electron transport chain, and the oxidation of formate through diphosphopyridine nucleotide (DPN) were demonstrated (Chow and Biale). Avocado mitochondria also synthesized fatty acids from acetate (Stumpf and Barber). In the apple the oxidation of carboxylic acids was accomplished (Tager), and cytochrome oxidase activity was obtained when phenolase was solubilized (Lieberman). Mitochondrial activity was found to depend on state of maturity. In the pepper fruit oxidative phosphorylation was demonstrated only in particles from mature fruit (Howard and Yamaguchi). In the avocado a supernatant fraction stimulated oxidation and dinitrophenol did not lower phosphorylation at the climacteric peak (Romani and Biale). This observation coupled with evidence for the increase in energy rich phosphate in avocado (Pratt, Rowan, and Robertson), incorporation of phosphate-P^{32} into ripe tomatoes (Marks, Bernlohr, and Varner), activation of aldolase and carboxylase in the banana (Tager and Biale), and the appearance of a malate decarboxylase in the apple (Neal and Hulme) suggests that the climacteric is a period of considerable synthetic activity and that ripening is an anabolic process.

BIBBEY, ROBERT O. Ontario Agricultural College. *The Inter-relationship between Gibberellin and Photoperiod as Expressed by Trifolium pratense L.* In experiments with the application of gibberellin on clonal plants of *Trifolium pratense* L. growing under vegetative photoperiods (13 hrs.), it was possible to obtain shoot elongation without differentiation of flower-bud primordia. At intermediate photoperiods (15 hrs.) untreated plants stayed strictly vegetative, while treatments of vegetative plants with gibberellin-induced stem elongation and subsequent flowering. A similar response was obtained from a three-week photoperiodic pre-treatment at 18 hrs., without gibberellin. Under strongly reproductive photoperiods (18 hrs.) treated plants flowered one week to ten days ahead of untreated. Evidence from sequence treatments with gibberellin in relation to the vegetative to reproductive photoperiodic switch suggests a parallel reaction between the photoperiod and gibberellin for at least two weeks after the switch. This possibly relates to overcoming the static condition of the shoot. The results do not support the thesis that gibberellin induces flowering. Rather they suggest that in *T. pratense*, at least, the chemical initiates shoot development and thereby renders it receptive to a reproductive photoperiod.

BIDDULPH, O. State College of Washington. *Simultaneous Bidirectional Movement of C^{14} Photosynthate and P^{32} in the Phloem.* By introducing $C^{14}O_2$ to the lowermost trifoliate leaf on the stem of a bean plant, and P^{32} to the next higher leaf, it was possible to study the simultaneous bidirectional movement of the two tracers through the phloem bundles in the included internode. The "bark" was removed and dried at –30°C. *in vacuo.* Autoradiograms showing the distribution of both tracers were prepared; then after the decay of the P^{32} a subsequent autoradiogram was prepared to show only the C^{14}. The autoradiograms were scanned with a recording densitometer across the same transect and by comparison (difference) the distribution of each isotope in each phloem bundle was determined. No single pattern of translocation was evident when all studies were compared. Variations included instances of predominant C^{14} translocation to predominant P^{32} translocation with interesting cases of simultaneous bidirectional movement of the two tracers, each in separate, approximately alternate bundles. Several patterns will be shown and discussed. The method has excellent possibilities for relating translocation and vascular anatomy.

Bidwell, R. G. S. National Research Council of Canada. *Precursors of Polysaccharides in Fucus vesiculosus.* A number of radioactive compounds have been supplied to samples of *F. vesiculosus* for different lengths of time, and the distribution of radioactivity in respired CO_2 and the various constituents has been determined. Compounds supplied were C^{14}-labeled mannitol, glucose, fructose, pyruvate, acetate, formate, and CO_2; also S^{35}-labeled sulphate. It has been concluded that alginic acid is formed more or less directly from CO_2 in photosynthesis. Laminarin and fucoidin appear to be more readily formed by the incorporation of hexose or mannitol. Although the carbon structure of fucoidin is relatively inert and very difficult to label with C^{14}, its sulphate is rapidly exchanged and it becomes strongly labeled with S^{35}.

Bier, John E. University of British Columbia. *Moisture Relations in Disease Development.* In recent studies a close correlation was found to exist between the development of Cryptodiaporthe canker on willow, Fusarium canker on black cottonwood, and Cephalosporium canker on western hemlock and the moisture content of the living, host bark. When bark moisture was expressed as a percentage of the amount of water required to saturate the sample under experimental conditions, relative turgidities of 80 per cent or more inhibited canker development which, however, occurred normally at lower percentages. It has been demonstrated that seasonal changes occur in the relative turgidity of the bark of the hosts which are closely correlated with the epidemiology of these canker diseases in the Vancouver area. Thus, during the dormant season, the monthly average temperatures were higher than the minimum temperature for the growth of the pathogens, and the relative turgidity of the bark of field willow and hemlock and nursery cottonwoods was appreciably less than the inhibiting value of 80 per cent. Cankers continued to develop throughout this period. During the growing season while temperatures were still more favourable for the development of the fungi, no extension of cankers occurred, apparently because, during the growing period, the relative turgidity was in excess of 80 per cent. During the dormant season the bark of field-grown black cottonwood maintained relative turgidity values of 80 per cent or higher and Fusarium canker could not be found on these trees.

Bingham, R. T. U.S. Forest Service. *The Intra-species Approach in Breeding for Disease Resistance in Trees.* Where a valuable, endemic tree species displays potentially useful variation in disease resistance, there is considerable merit in concentrating early breeding work entirely within that species. Under these conditions there is little to be gained by introducing problems of climatic, edaphic, entomologic, and pathologic adaptability almost certain to accompany early inter-species crossing. Nevertheless, long-range objectives may demand incorporation of resistance factors from a variety of related species. This is especially true where the pathogen is one capable of undergoing a rapid shift in predominance of its various biotypes, as may well occur within the "hybrid habitats" created by widespread planting of improved yet relatively homozygous new strains of trees. It is suggested that with valuable local species the greatest early gains, meanwhile avoiding climatic or other cataclysms, will come from intra-species breeding; also that in early-generation breeding work it may prove most productive to carry separate lines of promising native and introduced species — breeding within the native species for genetic gains of immediate usefulness, meanwhile breeding for greater general adaptability in promising introduced species.

BINGHAM, R. T., and A. E. SQUILLACE, U.S. Forest Service; and JONATHAN W. WRIGHT, Michigan State University. *Heritability of Resistance in Progenies from Blister Rust Resistant Pinus monticola Selections.* Progeny tests employing 9 randomized blocks in each of 76 progenies from control- and wind-pollinations among blister rust resistant *P. monticola* phenotypes were started in 1952. After intense artificial inoculation, progenies of average phenotype × average phenotype (control), resistant phenotype × wind, and resistant phenotype × resistant phenotype crosses survived to the extent of 5.3, 9.3, and 17.9 per cent, respectively. Differences between types of mating and between individual single-cross progenies within resistant phenotype × resistant phenotype mating type were highly significant. While the average control progeny contained 5 per cent survivors (probably largely escapes), the best wind-pollinated progeny of a resistant phenotype contained 19 per cent survivors and the best control-pollinated progeny of two resistant phenotypes 48 per cent survivors. Heritability of rust resistance, calculated from expectation mean squares, was estimated at 40 per cent. Assuming that future selection would be based upon the best progenies (regardless of type of combining ability demonstrated by the parents thereof), there existed a selection differential of 34.7 per cent and indicated genetic gain per generation was 11 per cent. While the indicated gain is not assured (constitution of the best materials is still little understood), chances are that a selection plateau — beyond which progress is nil — has not been reached. Results from these "first generation" progenies lead us to the conclusion that selection and breeding for rust resistance within species are both feasible and lucrative.

BIRECKA, HELENA, E. NALBORCYK, and T. SEBYLA. College of Agriculture, Warsaw. *The Alkaloid Metabolism in White and Yellow Lupines.* It was found that white lupines, both bitter and sweet, contained besides lupanine, hydroxylupanine, sparteine, angustifoline, and three other unidentified bases. The alkaloid content and the relations between the alkaloids depended on the age of particular organs and on the age of the plant as a whole. The alkaloid content in leaves increased in sweet lupines and decreased in bitter lupines as the leaves grew older. Diurnal changes were also observed. Investigations carried out with C^{14} have shown that plants deprived of roots and leaves were able to synthesize alkaloids. The same applied to yellow lupines, which, besides lupinine, contained sparteine, lupanine, hydroxylupanine, angustifoline, and two unidentified bases. However, differences in the rate of synthesis were observed. The relations between synthesis and decomposition of the particular alkaloids were different. Under certain conditions, some of the alkaloids, such as lupinine, showed a preponderance of synthesis; others, such as sparteine, had a higher rate of decomposition than of synthesis, so that a considerable decrease of the total alkaloid content might occur. Some alkaloids introduced into normal and root-deprived plants changed partially into other bases and also into non-alkaloid compounds. The relations between investigated alkaloids and their transformation will be discussed.

BISHOP, C. T. *See* GORHAM, P. R., *et al.*

BISHOP, NORMAN I. University of Chicago. *The Action of Certain p-quinone Derivatives on Photochemical Reactions Catalyzed by Chloroplasts.* French and co-workers observed that extraction of the petroleum ether soluble substances of lyophilized spinach chloroplasts resulted in decreased Hill reaction activity. Re-addition of this extract restored the initial dye-reducing capacity of the chloroplasts. They demonstrated that similar reactivation was possible with β-carotene and concluded that its specific removal by petroleum ether extraction was responsible for the lowered reactivity. We observed that certain derivatives of 1,4-naphthoquinones, namely vitamins K_1, K_3, and K_5, were also capable of restoring the photochemical activity of extracted chloroplasts, while under the same conditions pure β-carotene had no activating effect. Analyses to determine whether vitamin K, or its derivatives, occur in the petroleum ether extract have shown little evidence of them. Instead, a substituted p-quinone derivative was found in appreciable concentration. This compound has absorption maxima at 225 mμ (in absolute ethanol) for the oxidized state and at 290 mμ after reduction with sodium borohydride. Crane *et al.* have extracted this substance, Q_{255}, with iso-octane from spinach. We found that, like vitamin K, this new phylloquinone restores the Hill reaction of extracted chloroplasts. Further observations on Q_{255} and coenzyme Q_{10} will be discussed.

BISTIS, GEORGE N. Harvard University. *Heterothallism and Sexuality in Ascobolus stercorarius.* The relationship between sexuality and the functions of the mating-type locus has never been revealed in any heterothallic ascomycete. In *Ascobolus stercorarius* the early stages of sexual reproduction involve the interactions between a unicellular fertilizing element and a mature mycelium upon which are formed the ascogonia. However, these interactions occur only when the fertilizing element is from one incompatibility class and the ascogonial parent from the opposite class. At least two blocks to self-fertility have now been identified. The first is the "sexual activation" of the fertilizing element. The second occurs after plasmogamy and involves the maturation of the fruit body.

BISWAS, B. B., and J. MYERS. University of Texas. *Characterization of Desoxyribonucleic Acid from Anacystis nidulans.* As the nuclear apparatus in blue-green algae is peculiar, it has been considered worthwhile to investigate the nature of desoxyribonucleic acid from the cells of *Anacystis nidulans*. DNA has been isolated by three different procedures. The percentage of nitrogen of DNA varies from 13.85 to 14.30 and that of phosphorus from 6.75 to 8.20. DNA is found to have an absorption maximum at 257 mμ and an absorption minimum at 230 mμ. The average E (P) values are 5,301 (maximum) and 2,822 (minimum), respectively. The infrared spectrum of DNA shows peaks at 3/μ, 6.1/μ, 8.1/μ, and 9.3 to 9.8/μ. Purine and pyrimidine bases have been estimated quantitatively by different methods. It has been observed that DNA in this species is of GC type, that is guanine and cytosine predominating. The percentage moles of different bases are as follows: guanine 29-32, adenine 22-24, cytosine 24-26, and thymine 20-22. The molar ratio of guanine and cytosine (G/C) varies from 1.30 to 1.17, that of adenine and thymine (A/T) from 1.10 to 1.04, and that of purine and pyrimidine (Pu/Py) from 1.22 to 1.10. The residue resistent to pancreatic DNAase treatment precipitable with 50 per cent TCA contains adenine and cytosine in excess. It is indicated that the DNA from *Anacystis nidulans* can be fitted into the general model of DNA proposed.

BITANCOURT, A. A. Instituto Biológico, São Paulo, Brazil. *Alternative Pathways of Biosynthesis of Heteroauxin and Other Indole Derivatives.* The classical scheme of biosynthesis of indoleacetic acid (IAA) in plant tissues starts from tryptophan. Another possible pathway parallels the course of synthesis of tryptophan from indole and serine with glycolic acid substituting for serine. Tryptophan has been synthesized from anthranilic acid and ribose. In a similar condensation leading to IAA, succinic semialdehyde would substitute for ribose. All those pathways start from a cyclic compound. The structural analogy of IAA and the pyrrole unit of uroporphyrins suggests that IAA and other indole derivatives may have the same precursors as porphobilinogen, that is, succinic acid and glycine. The hypothetical alternative pathways of biosynthesis of indole derivatives from dicarboxylic acids of the Krebs cycle and amino acids, with pyrrole and o-aminobenzene derivatives as intermediates, form a network which can be called the "pyrrole-indole-aryl lattice" or "aryl lattice" for short. Physiological implications will be discussed at another session of this Section.

BJÖRKMAN, ERIK. Royal School of Forestry, Stockholm. *On the Metabolism of Monotropa hypopitys L.: An Epiparasite on Forest Tree Roots.* From investigations of the ecology of *Monotropa*, it has been found that the same mycorrhizal fungus occurs in *Monotropia* as in the roots of trees. In pure culture experiments under aseptic conditions, the mycorrhizal fungus isolated from the roots of *Monotropa* developed mycorrhiza on the roots of young pine and spruce plants. In nature the roots of *Monotropa* are always interwoven among the branching roots of, for example, pine and spruce, the whole being encased in a vigorous white fungal mycelium which has been found to penetrate into the roots both of the *Monotropa* and of the tree. In trenching experiments with plates lowered to about 70 cm. depth around *Monotropa* groups in such manner that all tree roots were isolated, *Monotropa* developed only to a very slight extent in the following year, whereas untouched *Monotropa* groups continued to develop normally on the same site from year to year. It appears probable, therefore, that *Monotropa* obtains its energy requirements from the trees via the mycorrhizal fungus common to them both. For the purpose of experimental study of this problem, some tests extending over a few years were conducted with the radioactive isotopes C^{14} and P^{32}. After administration of the C^{14} isotope to the phloem of pines and spruces with vigorous *Monotropa* groups at different distances from the trees, C^{14} was traceable in the *Monotropa* tissues especially in the groups nearest to the trees. In order to investigate what substances capable of attracting the mycorrhizal fungus are produced by *Monotropa* itself, a series of laboratory experiments was conducted on the mycorrhizal fungus of *Monotropa* and on a number of other hymenomycetes known to form mycorrhiza on pine and spruce.

Blackler, Helen, and G. Russell. The University of St. Andrews, Scotland. *The Autecology of Pylaiella littoralis (L.) Kjellm.* The variation in form and life cycle of species of *Pylaiella* will be reviewed and discussed in the light of cultural and field studies of the populations growing in the vicinity of St. Andrews. The three natural communities investigated are: (*a*) a permanent lithophytic community exposed to full wave action at about mid-tide level on the shore; (*b*) a seasonal community epiphytic chiefly on various members of the Fucaceae in the middle and lower littoral zone in the summer and in the upper littoral pools on *Cladophora rupestris* in the winter; (*c*) an early spring and summer community growing on mud and other substrates in the upper part of the harbour under conditions of shelter and reduced salinity. The lithophytic plants are morphologically similar to *P. rupincola* (Aresch.) Kylin, but its life cycle when grown in St. Andrews appears to differ from that recorded in Sweden.

Blake, Clara O. Brooklyn College *Niacin Metabolism in the Corn Seedling: Chromatographic Identification of Nicotinic Acid and Trigonelline.* In previous work it was shown that nicotinic acid was converted to trigonelline in seedlings of Tennessee inbred #13 corn grown in sterile culture to which nicotinic acid had been added. Determination of both substances was made by microbiological assay methods. This work is being repeated using varied extraction and purification methods, particularly paper chromatography with microbiological assay of the eluates. Aqueous extracts of dried embryos briefly pretreated with benzene indicate a positive response to microbiological assay at the R_f of trigonelline, nicotinic acid, and nicotinamide but none for N^1methylnicotinamide, the four substances regularly run on the chromatographs. Similar tissue exhaustively pretreated with chloroform and extracted with methanol shows activity at the R_f of trigonelline but not for the other three. Quantitative recovery experiments for trigonelline sulphate and trigonelline sulphate are being standardized, and, upon completion, control and nicotinic acid–fed seedlings will be analyzed and the results reported. Preliminary analysis of seedlings which were grown sterilely without added nicotinic acid, separated into two fractions, (1) shoots, and (2) cotyledons with roots, which were frozen, extracted with methanol, chromatographed and assayed, in general, yielded similar results for both fractions.

Blakeley, E. R. *See* Ciferri, O., *et al.*

Blank, F. McGill University, Montreal. *Ringworm in the Province of Quebec.* Extensive investigations in different parts of the Province of Quebec indicate that almost all forms of ringworm of the scalp and body occur in this region. Endothrix ringworm is endemic and epidemic in rural Eastern Quebec among a population which has had no contact with recent immigrants. So far, we have isolated only one species in each village concerned, either *Trichophyton tonsurans* or *T. sulphureum. T. tonsurans* has been isolated solely from the scalp while *T. sulphureum* has been found to cause ringworm both of the smooth skin and of the scalp in the majority of cases. The microsporosis cases noted have been almost exclusively due to *Microsporum canis*: besides family epidemics, a large outbreak involving 150 children and adults was observed in 1954 in Montreal. Three foci of this condition existed in Montreal for several years, but have since died out. *M. audouini* and *M. gypseum* infections are extremely rare. Ringworm of the microide type *sensu* Sabouraud has been encountered in rural and urban areas. In these instances, it has always been possible to identify the sources of infection as small rodents. Dermatomycosis due to contact with cattle is frequent and *T. discoides* is isolated exclusively. Cases of human favus (*T. schoenleini*) have been found in all parts of the province where ringworm surveys have been carried out. Many of these favus cases were of long duration, and were even found in members of three consecutive generations. The epidemiology of human favus presents unsolved problems. Favus of mice (*Microsporum quinckeanum*) has been found in the lower St. Lawrence Valley where isolated cases and family epidemics occur. Mice have been shown to harbour the pathogen while cats and dogs transmit the disease to man.

BLANK, F. *See* KAPICA, LUCIA, *et al.*

BLISS, LAWRENCE. University of Illinois. *Productivity of Alpine Plant Communities on Mount Washington, New Hampshire.* A comparative study was made of micro-environments, plant development, and plant production of various exposures on Mt. Washington during two summers. Communities of *Carex bigelowii* Torr. predominate on the north and west exposures while rush-dwarf heath shrub communities are most important on east and south exposures. Growing season measurements of 4-inch air, surface, and 4-inch soil temperatures, vapor pressure deficit, and solar radiation were higher on the southeast slope while wind, precipitation, and available soil moisture were greater on the northwest slope. Soils on the two exposures are quite different. In general, plant growth, measured as stem elongation, was more rapid and produced taller plants on the southeast exposure than on the northwest slope when the same species were considered. Total net plant production based on weekly quadrat clippings of aerial plant material for the current year was greater on the latter slope due largely to the species present, their growth form, and a much denser plant cover. Plant production at the end of the growing season expressed as grams/m.^{2}/day is quite comparable with data from other tundra ecosystems.

BODE, H. Kamen/Westf., Germany. *Die Entwicklung der Megaflora im höheren Oberkarbon und die Sporengliederung.* Die Pflanzenwelt des Karbons lässt an der Wende vom Westfal zum Stefan eine sehr bemerkenswerte Umwandlung erkennen. Die westfälische und die stefanische Flora sind scharf voneinander unterschieden. Von den typischen Formen des Westfals findet sich keine einzige in der Stefanflora, keine der Charakterarten des Stefans kommt in der westfälischen Flora vor. Zwischen beiden liegt eine Zone des Uebergangs, in der die westfälischen Formen allmählich ausklingen, die stefanischen nach und nach erscheinen. Diese Uebergangszone ist gekennzeichnet durch das Auftreten der Neuropteris ovata ("Zone der *Neuropteris ovata*"); die an ihrer Basis erstmalig auftretenden echt stefanischen Pflanzenarten leiten floristisch den Uebergang zum Stefan ein. Der Uebergang von der westfälischen zur stefanischen Flora ist in seinem Ablauf in der ganzen Welt gleichartig und stellt deshalb ein entwicklungsgeschichtliches Merkmal von besonderer Bedeutung dar, das für die Stratigraphie von grösstem Wert ist. Er ist palynologisch bisher nicht erkannt und kommt in den Sporengliederungen nicht zum Ausdruck. Das gilt insbesondere für die von den Verhältnissen im Saarkarbon ausgehende Gliederung von Bhardwaj. Die darin auf Grund des Auftretens der Densosporen vorgenommene Grenzziehung wird durch die Megaflora nicht gestützt. Die stratigraphische Bedeutung der Densosporen ist danach noch nicht erwiesen.

BOGORAD, L. *See* BELL, W. D., *et al.*

BOKE, NORMAN H. University of Oklahoma. *Determinate Shoot Meristems in the Cactaceae.* Exclusive of floral primordia and the intercalary meristems at the bases of growing spines, there appear to be four types of determinate meristems in the shoot systems of the Cactaceae. (1) In jointed forms, such as the platyopuntias and *Rhipsalis*, growth is sympodial and the apical meristems are determinate. (2) Many species, particularly those with ribs or tubercles, have a distinctive hypodermal meristem which produces photosynthetic palisade tissue. (3) Cacti with relatively thick stems usually have a diffuse thickening meristem in the middle and inner cortex. In *Echinocactus grusonii* this is so well developed that it resembles the primary thickening meristems found in palms. (4) In the mammillarias and some of their relatives the two areoles associated with each tubercle may be interpreted as serial buds. The one in the axil of the tubercle produces either a flower or a branch; the one at the summit of the tubercle produces only spines and is determinate. Although spine initiation usually begins on the posterior flank of the spiniferous meristem, the final arrangement of the primordia may be asymmetric (*Mammillaria pottsii*) or radial (*Mammillaria herrerae.*)

BOLD, HAROLD C. University of Texas. *Some Taxonomic Problems in Unicellular Chlorophycean Algae.* The large number of unicellular chlorophycean algae makes their identification by inspection in mixed collections virtually impossible, as is the case with bacteria. The only basis for a satisfactory taxonomic system lies in the preservation of these organisms in clonal, unialgal, and/or pure culture for comparative study. This is especially true because herbarium specimens of these algae fail to preserve the very morphological attributes on which their taxonomy has been established. The generic and specific attributes and life cycles of unicellular Chlorophyceae with motile stages will be reviewed, together with their range of variation, methods for studying them, and their distribution. Their taxonomic criteria will be illustrated by Kodachrome slides. Genera to be discussed include: *Chlorococcum, Neochloris, Spongiochloris, Spongiococcum, Bracteacoccus, Dictyococcus, Dictyochloris, Nautococcus, Trebouxia, Chlorosarcina, Chlorosarcinopsis, Chlorosphaeropsis, Chlamydomonas, Palmella,* and *Gleocystis,* among others.

BOLL, W. G. *See* LOWTHER, RUTH L.

BOLSUNOV, IGOR. Tobacco Breeding Station, Fuerstenfeld, Austria. *Possibilité de prédire, chez les plantes autogames, la manifestation du phénomène d'hétérosis par le phénotype des parents.* Bien que l'effet d'hétérosis dépende des propriétés génotypiques, il y a pourtant possibilité de prédire une manifestation de la vigueur hybride par le choix des parents d'un croisement selon certains phénotypes. Selon les données de la littérature et la riche expérience des sélectionneurs — y compris les observations faites par l'auteur — l'effet d'hétérosis chez les plantes autogames peut être observé le plus souvent dans les croisements suivants: dans quelques croisements interspécifiques; dans l'hybridation entre les sous-espèces; dans l'hybridation de variétés géographiquement éloignées; par hybridation de formes morphologiquement contrastantes. A part les possibilités énumérées, l'auteur a pu, au cours de ses recherches de longues années, trouver encore deux autres types de croisements qui laissent espérer la manifestation de la vigueur hybride avec une fréquence considérable. Il s'agit du choix des partenaires du croisement d'après la manifestation phénotypique de quelques caractères quantitatifs à la suite de l'influence du milieu. Les régularités qui peuvent en être déduites ont été observées chez plusieurs centaines d'hybrides F_1 de *N. tabacum,* de *N. rustica* et, dans une certaine mesure, aussi chez quelques autres plantes autogames. La possibilité de se servir des caractères phénotypiques des parents comme indicateurs d'une vigueur hybride possible, présente un intérêt tant pour l'investigation ultérieure de la physiologie de la manifestation de ce phénomène comme aussi pour des buts pratiques de l'amélioration des variétés.

Bonner, Bruce A. Yale University. *The Effect of Modified Atmospheres on the Photo-control of Pea-epicotyl Section Growth.* Various theories to explain red–far-red photomorphogenic responses have postulated a close interrelationship with some component of the respiratory mechanism. In an effort to test the hypothesis that the oxidation-reduction state of the plant may alter the efficiency of a given light treatment, excised etiolated pea-epicotyl sections were given red and far-red light treatments in various atmospheres and the subsequent growth in air was measured. Thirty minutes of anaerobic (N_2) conditions had a very limited effect in itself upon subsequent growth. Red-light inhibition of sucrose- and cobalt-induced elongation and the reversal of this inhibition by far-red proceed equally well in air and in nitrogen atmospheres. Serial red and far-red treatments produce similar responses aerobically and anaerobically. Appropriate dose-response curves and the effect of alterations of the CO_2 atmosphere will be presented.

Bonner, James. California Institute of Technology. *Action of Auxin in the Growth of Shoots.* The presence of an auxin in appropriate concentration increases the rate of expansion of many kinds of cells and tissues. In the oat coleoptile section, for example, conditions can be so arranged that expansion in the absence of applied auxin takes place at a steady slow rate. Upon the addition of auxin this steady rate is increased within minutes by a factor of 7 to 10. Rate of cell expansion is immediately determined by two factors: (*a*) load upon the cell wall, and (*b*) resistance of the wall to deformation under load. Many studies have shown that the application of auxin does not immediately alter (*a*) (load, osmotic concentration in this instance) but dramatically decreases wall resistance to deformation under load. The final manifestation of auxin action is therefore upon the chemistry of the cell wall which is softened in the presence of auxin. Appropriate studies with C^{14}-labeled precursors have shown that the presence of an auxin increases rate of production of the methyl ester groups of cell-wall pectin in the oat coleoptile. The effect possesses all the earmarks of a true auxin-controlled reaction. It appears, therefore, that the action of auxin in cell extension may well be mediated through the pectic metabolism.

BOONE, D. M., and G. W. KEITT. University of Wisconsin. *Genetics and Nutrition of Venturia inaequalis in Relation to Its Pathogenicity.* Different alleles at a locus in wild-type lines of *Venturia inaequalis* (Cke.) Wint. were found to control whether a "lesion" (typically pathogenic) or a "fleck" (non- or only slightly pathogenic) reaction would be incited with leaves of a certain host variety or group of varieties. Genes at other loci were shown to similarly control pathogenicity to other host varieties or selections. Certain induced biochemical mutants were pathogenic like the wild-type line from which they were derived, while others, mainly those requiring nitrogen bases or amino acids, were non-pathogenic unless their nutrition was supplemented from a source outside the host. Mixtures of different biochemical mutants grew synergistically *in vitro* and *in vivo* on apple seedlings. Cytological investigation revealed that the chromosome number of the fungus is seven. Genetic studies established markers linked to seven centromeres. Examples were found of single-gene control of resistance in the host to all known races of the fungus, to certain races, or to only certain lines. In other cases control of resistance appeared to be multigenic. Polyphenolic compounds in the host were shown to be of potential importance in relation to disease resistance.

BOPP, MARTIN. Freiburg Br. Botanisches Institut. *Some Aspects of the Problem of Differentiation of Protonemata.* When *Funaria hygrometrica* or a number of other mosses (e.g., *Fissidens bryoides, Barbula unguiculata*) are cultivated on an artificial medium, the protonema shows a distinct differentiation in two sections, which could be interpreted as juvenile and adult forms (chloronema and caulonema). The cells of these two sections show a clear difference under the electronic microscope. Usually only the adult form produces the buds of the moss. Under certain conditions (e.g., submerged cultivation or a temperature of 5°C.) protonemata grow for a longer time in the juvenile form. The formation of buds then is either hampered or completely suppressed. Furthermore, there is a true difference of the two forms in their phototropic reaction: the chloronema is positively phototropic, the caulonema is negatively phototropic. Different varieties of the same species differ in their response in this respect. Finally, both the chloronema and the caulonema differ in their ability to hamper another chloronema or caulonema, respectively. In the adult form, the protonemata mutually inhibit growth; whereas in the juvenile form they grow towards one another without any sign of inhibition. These experiments clearly demonstrate that chloronema and caulonema are facts and that the difference between them is real and evident.

BORMANN, F. H. Dartmouth College, Hanover, New Hampshire. *Intraspecific Root Grafts and Transport.* The forest tree is often considered an independent organism whose principal relationship with its neighbors is one of competition for light, water, and minerals. Yet there is ample evidence that under forest conditions two or more trees may be linked together through intraspecific root grafts. Such grafts have been reported in at least 56 forest tree species and in 40 of these various workers have judged grafts to be common. That grafts may be functional in transport between trees has been demonstrated by translocation of dyes, radioisotopes, poisons, and other substances and by the movement of food as evidenced by the maintenance of growth in stumps grafted to living trees. Often groups of trees are united through root grafts early in the life of a stand, and as the stand matures, the tops of some trees in the union die, but their roots remain alive in the root network. This suggests that the members of a union have lost at least a part of their individuality and may be subjected to biochemical and biophysical influences by their grafted companions. A tree's ability to persist as a visible member of a union may be determined by its ability to dominate the physiology of the union.

BOSE, SMRITIMOY. University of Virginia. *Phylogeny and Karyotype Evolution in Lycoris.* Of the fifteen taxa of *Lycoris* studied, somatic numbers of 12 and 13 are found in *L. traubii*; 12, 13, 14, and 15 in *L. aurea*; 15 in *L.* "sperryi"; 16 (15) in *L. chinensis*; 17 in *L. albiflora* and *L. elsiae*; 22 in *L. haywardii*, L. *radiata* (fertile), L. *sanguinea*, and L. *sprengeri*; 27 in *L. caldwellii* and *L. squamigera*; 29 + 1B in L. *incarnata*; 30 in *L. houdyshelli*; and 33 in *L. radiata* (sterile). The chromosomes can be broadly divided into V- and rod-shaped elements. Karyotype analyses show five major types of chromosomes plus a very short euchromatic (B) chromosome. No taxon has all V-shaped chromosomes, five have all rod-shaped chromosomes and ten have both V- and rod-shaped chromosomes. The several taxa might be divided into the two groups having: (1) actually or potentially the equivalent of 22 rod-chromosomes; and (2) the equivalent of 33 rod-chromosomes. Speciation and chromosome number variation have apparently occurred within each of the two groups without the addition of extra chromosomal elements. Both fusion and fragmentation theories are considered with regard to the basic number, karyotype evolution, and speciation. Translocation, inversion, telocentric chromosomes, centromeric structure, and polyploidy are also considered in this respect. Different chromosome races within the same species, karyotype variation from taxon to taxon, and successful interspecific hybridizations indicate phylogenetic relationships and origins of the several taxa.

BOSSHARD, H. H. Laboratorium für mikrotechnologische Holzforschung E.T.H., Zürich. *Influence of the Microscopic and Submicroscopic Structure on the Anisotropic Shrinkage of Wood.* The coefficient of anisotropic shrinkage, ε, varies within a fairly wide range from 1.2 to 3.7, depending on the density of timbers. Considering the high heterogeneity of wood it is obvious that its microscopic and submicroscopic structure influences the shrinkage mechanism. The correlation of shrinkage data of some timbers with measurements of their specific micro-structure points to the high importance of the ray system. The rays cross the timber body perpendicular to the grain. Their shrinkage, for example, in a tangential section, cannot be the same as for the longitudinal tissues, but is significantly higher. Thus the tangential shrinkage of a wood block is the result of the shrinking of the longitudinal cells plus that of the ray system. As to the submicroscopic structure, it may be attributed to the influence of the different chemical components on wood shrinking. The pectin and the hemicellulose substances swell and shrink, the lignin remains more or less unmovable. A high lignin content hinders the shrinkage and a different lignin content in radial and tangential cell walls raises to an anisotropic behaviour of shrinkage. Taking account of that fact it is possible to discover another reason for the phenomenon of anisotropic shrinkage.

Bosweg, Ritzema. *See* De Zeeuw, Dick

Bould, C. University of Bristol. *Leaf Analysis as a Guide to the Nutritional Status of Soft Fruit Crops.* Seasonal changes in the major nutrient element concentrations of black currant (*Ribes nigrum*) and strawberry (*Fragaria* sp.) leaves are discussed in relation to time of sampling. Methods of whole-leaf and leaf-disc sampling are described, and the results of a variance component analysis on sampling and analytical errors are given. Field and sand culture methods used at Long Ashton for studying the relationship between leaf nutrient status and plant performance are described, and tentative deficiency, marginal, and sufficiency leaf-nutrient levels for strawberry at different growth stages are suggested.

Bourdeau, Philippe F. Yale University and Université Officielle du Congo Belge et du Ruanda-Urundi. *Vegetative Growth and Photosynthesis of Pinus elliottii Seedlings in Relation to Photoperiod.* Various experiments were conducted to determine the optimum photoperiod to grow slash pine, *Pinus elliottii* Engelm., seedlings under greenhouse conditions. Natural daylength and photoperiods of 8, 16, 20, 22, 23¼, and 24 hours were compared. Height growth increased markedly with increasing photoperiod and was significantly better in continuous light than in the 23¼ hours treatment. Fresh weight, dry weight, and shoot-root ratios varied similarly, but chlorophyll content decreased. The differences in height growth were mostly due to differences in internode length, seedlings under natural daylength producing the shortest internodes during the winter months. Low-intensity supplementary light was as effective as high-intensity light. Incandescent lamps gave better results than fluorescent tubes. The course of daily photosynthesis of seedlings submitted to various photoperiods was followed simultaneously, using infrared CO_2 analysis. The supplementary light was well below compensation point. No difference in the pattern of daily variation appeared nor was there any instance of midday depression of the photosynthetic rate. Applications of gibberellic acid had no effect under medium and long photoperiods but stimulated stem elongation under 8-hour photoperiods.

Boureau, Edouard. Organisation Internationale de la Paléobotanique, Joinville-le-Pont, France. *Rapport sur l'Organization de la Paléobotanique dans le monde.* L'auteur donnera un discours sur l'Organization internationale de la Paléobotanique (I.O.P.), un compte rendu de l'activité de l'I.O.P. depuis 1954. Il parlera de la modification des statutes et du project d'activité de 1959 à 1964. Questions diverses seront discutées.

Bourrelly, Pierre, P. C. Laboratoire de Cryptogamie du Muséum National d'Histoire Naturelle, Paris. *Les Grands Problèmes écologiques en algologie d'eau douce.* Dans l'état actuel des études écologiques sur les algues d'eau douce, il semble que les conditions physiques et les qualités chimiques du milieu d'une part, et d'autre part les associations végétales qui peuplent les eaux sont assez bien connues. Ce qui reste trop souvent mystérieux ce sont les relations entre algues et milieux aquatiques, les interréactions entre les diverses espèces animales et végétales d'une population naturelle. Le grand problème du peuplement algal et de l'échelonnement successif des florules saisonnières, ainsi que la question des épibiontes préférentiels ou exclusifs, restent encore mal connus. Nous soulignerons de plus l'intérêt, en tant qu'indicateurs biologiques, des espèces rares, à aire de distribution restreinte et besoins écologiques particuliers. L'analyse rapide des diverses tendances des "écoles" écologiques et de leurs techniques de recherches permet d'avoir une vue d'ensemble sur les résultats obtenus et sur les questions qui restent encore à résoudre.

BOVE, COLETTE. *See* CONN, ERIC E.

BOWDEN, WRAY M. Canada Department of Agriculture. *Cytotaxonomy of the Wheats and Their Allies.* The genus *Triticum* L. emend. is treated to include the diploid, tetraploid, and hexaploid wheats (*Triticum* L.) and the diploid, tetraploid, and hexaploid species of hybrid origin which were formerly placed in the genus *Aegilops* L. In the genus *Triticum* L. emend., there are ten homogenomic diploid species; one heterogenomic allotetraploid wheat species of hybrid origin, *T. turgidum* L. emend., which includes many cultivars, three botanical varieties, and one hexaploid form; one heterogenomic allohexaploid hybrid wheat complex, *T.* × *aestivum* L. emend., which includes many cultivars; eleven other heterogenomic allotetraploid or allohexaploid species of hybrid origin; and numerous other artificial and natural interspecific hybrids. Herbarium specimens are demonstrated.

BOWEN, C. C. Iowa State College. *Fine Structure of the Mitotic Spindle in Psilotum.* Sporangia of *Psilotum nudum* were fixed in buffered osmic acid and embedded in methacrylate. Ultra-thin and adjacent thicker sections have been studied under the electron and light microscope respectively. The so-called "traction fibers" of metaphase were found to be compound, each consisting of several tubular elements, closely appressed and of various diameters. The so-called "continuous fibers" of anaphase and telophase were more difficult to study, but appear single and qualitatively different from the "traction" elements. Changes in the spindle as mitosis progresses are described. (This work was supported by Grant C-3982 from the National Cancer Institute of the National Institutes of Health, U.S. Public Health Service.)

BOWLER, EDWIN. *See* SCOTT, FLORA MURRAY, *et al.*

BOYES, J. W. McGill University. *Demonstration of Embryo-sac Development of Plumbagella micrantha.* The unique development of the tetrasporic embryo sac of *Plumbagella micrantha* from the macrospore mother cell involves three divisions, as described twenty years ago by the writer. After the two meiotic divisions, three of the four resulting macrospore nuclei migrate to the chalazal end of the embryo sac where they unite on arrival or later during the ensuing mitotic division. This division of the chalazal complex ($3n$ chromosomes) is accompanied by division of the micropylar macrospore nucleus (n chromosomes) so that the embryo sac becomes four-nucleate again. One micropylar nucleus (n chromosomes) becomes the nucleus of the egg cell, the other unites with one of the chalazal nuclei ($3n$ chromosomes) to form a tetraploid primary endosperm nucleus, and the other chalazal nucleus becomes the nucleus of the single antipodal cell. Anomalous six-nucleate embryo sacs sometimes result if one nucleus lags behind during the chalazal migration of the three megaspore nuclei. Stages of development will be demonstrated using the original microscopic preparations which are still remarkably clear, and drawings and photographs of many stages.

Boyko, Elisabeth. *See* Boyko, Hugo

Boyko, Hugo, and Elisabeth Boyko. Rehovot, Israel. *Seawater and Saltwater Irrigation.* Observations since 1929 led the authors to undertake irrigation experiments with brackish water and later with seawater on sand and gravel. In the absolute desert climate of Elath (Israel), an experimental desert garden was planted on the completely vegetationless hills with highly permeable soil. Irrigation water had 2,000-6,000 mg./1 total salt content. About 180 species were successfully introduced. The development is shown in photos. On the basis of these results an experiment has been carried on for the last two years with ecologically extremely different plant species. They were irrigated with controlled amounts of seawater in various dilutions up to oceanic concentration. The results with these plants are shown in photos and graphs. Soil analyses in 10 cm., 30 cm., and 60 cm. depth show that even after an eight-month rainless period with exclusive daily irrigation with seawater no accumulation takes place in the root layer if the permeable soil has an adequate depth in relation to the root system (in our case 90-130 cm. soil depth to 60 cm. root-depth). Similar experiments are advocated because the results indicate great possibilities for increasing the productivity of deserts and coastal dunes of many countries.

Boynton, Damon, and Lawrence Yatsu. Cornell University, Ithaca, New York. *Some Factors Influencing the Intermediary Nitrogenous Compounds in Leaves of the Strawberry Plant (Fragaria chiloensis var. Ananassa).* Two-directional paper chromatography provides opportunities for the quantitative separation of intermediary nitrogenous compounds, whose concentrations in leaves may give information useful in the diagnosis of nutritional problems. In the study reported, information is presented on the effects of environmental conditions, and of treatments affecting the growth status, on these soluble nitrogen compounds in strawberry leaves.

Braarud, T., and K. Ringdal Gaarder. University of Oslo. *Morphology and Taxonomy of Coccolithophorids.* The microstructure of coccoliths as seen in electron microscope is described for a number of marine coccolithophorids. The range of differentiation in the holococcolith group is shown to include forms which, according to light microscope observations, would be expected to have heterococcoliths, for example, *Homozygosphaera (Syracosphaera) quadriperforata* (Kpt.) Gaarder. The morphology of the various kinds of coccoliths within genera of Halopappinae is described. The coccoliths of the arms are interpreted as extreme modifications of the heterococcolith-type of the cell-cover. The morphology of *Thorosphaera* and *Scyphosphaera* is considered, especially the distribution of coccoliths on the cell surface. Taxonomic questions as regards the genus *Cyclococcolithus* are discussed in connection with observations on *C. sibogae* (Weber van Bosse) Gaarder. In *Zygosphaera wettsteinii* Kpt. the occurrence of a haptonema is demonstrated. The taxonomical value of this organ in coccolithophorids is discussed in connection with recent observations by Parke and Von Stosch and, likewise, the occurrence of sedentary stages.

Bradley, Roy H. Fredericton Regional Research Laboratory, Canada Department of Agriculture. *Our Concepts — On Rock or Sand?* Time devours our concepts — more greedily of late it seems than ever before. Yet scientists, who perhaps most of all should know this, often build their own thoughts as if on rock not sand. The result is seldom more than a frail hypothesis. For example, those of us who seek how aphids transmit viruses during brief probes generally believe that to starve aphids before they take up and transmit the virus greatly increases the number that do so; and also that this effect is soon undone if the aphids feed more than a few minutes on the source of virus. From this we try to explain how starving causes an effect undone by feeding. But we do not get far; for our thoughts are chained to narrow concepts of what the terms feeding and starving mean here. Feeding encompasses much more than the ingestion of food, which is about the boundary of our thinking; and starving depicts all that happens to aphids when they are forcibly removed from their host plants and jailed for a time to wander hopelessly in search of plants. If this starves, may it not also injure, upset, or even frustrate? I shall describe experiments that show that the effect we attribute to starving may well be due to other causes.

Brandt, William H., and C. H. Wang. Oregon State College. *Catabolism of C^{14}-labeled Glucose, Gluconate, and Acetate by Verticillium.* The major catabolic pathways of glucose in conidia from rapidly proliferating shake-cultures of *Verticillium albo-atrum* Reinke & Berth. isolated from okra and cultured under light at 25° C. have been identified and estimated from data obtained by the radiorespirometric method. When pure oxygen was used as a sweep gas, glucose appeared to be catabolized approximately 60 per cent via the Embden-Meyerhof-Parnas glycolysis and 40 per cent via phosphogluconate decarboxylation. With air as the sweep gas, about 48 per cent of the glucose was catabolized via the EMP pathway and about 52 per cent via the PGD pathway. Glucose was catabolized under a pure nitrogen atmosphere, but there was little PGD operating under these conditions. Gluconate was rapidly decarboxylated in the C-1 position, but only a small proportion of carbon atoms from other positions appeared in the respiratory CO_2. Acetate was utilized readily in such a way that the operation of the tricarboxylic acid cycle may be inferred. Pyruvate was used slowly, presumably because of the limited permeability of the conidia to this substrate.

Brebion, G., et R. Scuflaire. Institut National de Recherche Chimique Appliquée, Annexe du Bouchet, Vert-le-Petit, France. *Action de quelques uréïdes sur la croissance et la chlorophyllogénèse de Triticum sativum.* Les résultats obtenus précédemment par l'un des auteurs nous ont incité à rechercher l'influence de la structure chimique sur les phénomènes observés. Nous avons étudié l'action des substances suivantes: (1) uréïdes à chaîne ouverte — bromodiéthylacétylurée, bromométhyldiméthylacétylurée, isopropylallylacétylurée; (2) uréïdes à chaîne fermée: (*a*) série barbiturique: saturé symétrique — diéthylmalonylurée; saturé symétrique — butyléthylmalonylurée; non saturé asymétrique — ethyl-allylmalonylurée, allyl 2 butylmalonylurée; à substitution cyclique — éthylphénylmalonylurée, cyclohéxenyl-éthylmalonylurée, N méthylocyclohéxenylméthylmalonylurée; thiobarbiturique-éthyl 5 méthylbutyl 5 thiomalonylurée (sel de sodium); (*b*) série des hydantoïnes — diphényl 5-5 hydantoïne, diméthyldithio-hydantoïne. Ces substances sont en général des inhibiteurs de la chlorophyllogénèse et de la croissance. (1) Les différences de concentrations observées dans les seuils d'action nous ont conduit à déterminer les diverses activités thermodynamiques correspondantes. (2) En général, la croissance de *Triticum* est plus sensible, pour un uréïde donné que la chlorophyllogénèse. (3) Aux faibles concentrations, on observe fréquemment une excitation des phénomènes de chlorophyllogénèse et de croissance. En particulier, les composés à chaîne droite provoquent un développement intense du système radiculaire. (4) Nous essayons de préciser le mode d'action de ces substances par des dosages en série de glucides, acides aminés et organiques, esters phosphoriques, etc.

Brebion, G. *See* Scuflaire, R.

Bretz, T. W. University of Missouri. *Oak Wilt: Present Status and Future Needs.* At the present time our knowledge of oak wilt is reasonably well developed in respect to symptomatology, suscept range, geographic distribution, and the nature and classification of the primary causal agent (*Ceratocystis fagacearum* (Bretz) Hunt). In respect to other aspects of this problem, however, precise information that is basic to our understanding of the disease as it occurs in nature is lacking. Such phenomena in the life history of the pathogen as the nature and sources of inoculum; the time of inoculum dispersal and the agents involved; the exact nature of the infection court and the specific conditions requisite for infection; the duration of the incubation period; the pathogen's developmental pattern during the infection period; and its saprophytic development, require further investigation. The nature of resistance in suscept species and species groups and the physiological processes that lead to wilting and death or recovery of the suscepts need clarification. The existence and/or possible development of physiologic races of the fungus should be determined. And finally, those environmental factors that influence the growth and development of the pathogen and the suscept, which in turn may affect the incidence of wilt and determine its present distribution, need to be more clearly defined.

Brewbaker, James L. Brookhaven National Laboratory, New York. *Incompatibility and the Pollen Grain.* Self-incompatibility occurs in at least 68 families sprinkled liberally throughout the Angiosperms. The incompatibility inhibitions occur at either of two major sites; on the stigma (at or immediately following pollen germination) and in the style or ovary. Angiosperm species shed their pollen grains at either a binucleate or a trinucleate stage. Only rarely are both types of species observed in the same genus. Of 210 families surveyed, 132 show only binucleate genera, 48 only trinucleate; in 20 families both types are found. The incompatibility inhibition of binucleate grains occurs only in style or ovary (28 genera) and of trinucleate grains predominantly on the stigma (15 genera), rarely in the style (3 genera). Binucleate grains commonly characterize species with gametophytic expression of homomorphic S-allele phenotypes, and trinucleate, the sporophytic system (exceptions will be cited). Related phenomena of interest are: (1) binucleate grains germinate more readily *in vitro* than trinucleate (all aquatic plants with submerged flowers appear to be trinucleate); (2) binucleate grains generally have a lower osmotic pressure; (3) they survive storage better than trinucleate; and (4) the binucleate condition is phylogenetically primitive. These observations will be related to the timing of second mitosis and suggested metabolic demands on the developing gametophyte.

Brian, Percy W. Akers Research Laboratories, Welwyn, England. *Interactions between Gibberellins and Auxins.* Gibberellins and auxins have somewhat similar effects on such aspects of plant development as stem-extension, parthenocarpic fruit development, cambial activity, and leaf abscission. Contrarily, in effects on root initiation and development of lateral buds, gibberellins differ markedly from auxins. These observations have stimulated investigation of physiological relations between the two kinds of hormone. In effects on stem-extension, gibberellins and auxins are synergistic. There is evidence that gibberellin acts by antagonising a third factor which limits response to auxin. This factor may be involved in auxin destruction and gibberellin therefore may be "auxin-sparing," but some observations are incompatible with this interpretation. Gibberellin : auxin synergism has been demonstrated in parthenocarpic fruit development, in cambial activity, and in potato stolon formation; in these cases an auxin-sparing mechanism seems unlikely. In effects on adventitious rooting and on cell multiplication in certain tissue cultures, gibberellins reduce effects of auxins. It is not now possible to interpret these various types of interaction by any unitary hypothesis. Two conclusions can be drawn: (*a*) auxins and gibberellins have distinct but metabolically related modes of action; (*b*) since the status of gibberellins as natural plant hormones has now been established, explanations of control of plant development must in future be sought in terms of hormonal interactions, rather than in effects of a single hormone.

Briggs, W. R. Stanford University, California. *Multiple Light Exposures and the Phototropic Response.* Light exposures which normally elicit from corn coleoptiles either tip curvature alone or tip and base curvature are ineffective when administered at high intensity for a short exposure-time. They may be made effective by administering them in flashes with intervening dark periods. For instance, with a two-minute exposure at 250 meter candles, at 25°C., the optimum light period is 0.004 secs., and the optimum dark period 0.03 secs. These conditions result in about 25° of curvature response, whereas the uninterrupted two-minute exposure produces no response at all. Another type of experiment, also done at 25°C., involves an initial high intensity and ineffective exposure, followed at various time intervals by a low intensity and fully effective exposure. For two minutes following the high intensity exposure, the second exposure is ineffective. However, between two and 20 minutes following the first, the second gradually increases in effectiveness, until after 20 minutes, the second elicits a normal response. Failure of response at light dosages of high intensity is the result of a combination of photo-inactivation of the responding system and limitation imposed by a dark reaction. The bearing of these results on the nature of the phototropic response is discussed.

Briggs, Winslow R. *See* Gillespie, Barbara

Brinkman, Sherry A. *See* McDonough, E. S., *et al.*

Broadfoot, W. C. *See* Kasting, Robert, *et al.*

Brock, T. D. Western Reserve University, Cleveland. *Physiological Processes in the Conjugation of Mating Types in the Yeast Hansenula wingei Wickerham.*

When cells of the two mating types of *H. wingei* are mixed and aerated in a simple nutrient medium, rapid conjugation and cell fusion occur, resulting in up to 80 per cent conjugants in five hours. Microscopic studies in slide culture indicate that fusion occurs because each cell of a mating pair elongates on the side where it touches its opposite member. After several hours the cross-wall between the cells disappears and at this time further elongation of the conjugants ceases. For fusion to occur, both cells must be metabolically active. A variety of experiments have shown that conjugation is due to induction of a budding enzyme in each cell type by contact with its opposite type. These results indicate that conjugation may result from reciprocal induction in each cell of an enzyme which digests a portion of its own cell wall. Conjugation can therefore be viewed as an extension of the normal budding processes, induced by contact with cells of opposite mating type. Thus the mating process in yeast does not require the postulation of hormones which diffuse into the medium, although the possibility of direct cell-to-cell transfer of such hormones cannot be ignored.

BROOKS, F. A. *See* TURRELL, F. M., *et al.*

BROWN, A. G. *See* SHAY, J. R.

BROWN, CLAIR A. Louisiana State University. *A 35,000-year-old Flora and Its Relation to Louisiana Geology.* The excavation of the Hopper Gravel Pit in the Amite River valley, about 17 miles northeast of Baton Rouge, La., revealed a layer of logs under cross-bedded sands and gravels. Below the logs was a layer of clay rich in organic matter with stumps in place. Some 54 wood samples have been identified as southern yellow pine, southern white cedar, cypress, oak, ash, hickory, sycamore, red gum, and black cherry. Other macroscopic remains in the clay consisted of branchlets, cones, and seeds of southern white cedar, staminate aments of pine and birch, containing pollen, acorn cups, fascicles of pine needles, and capsules of titi. Analysis of the clay revealed the pollen of pine, oak, hickory, birch holly, beech, magnolia, cypress and/or southern white cedar, water lily, grass, and Compositae. All the plant remains are represented in the extant flora with the exception of the southern white cedar, *Chamaecyparis thyoides*. This species grows in adjacent southeastern Mississippi. An age determination of greater than 35,000 years was obtained from C^{14} analysis of one of the pine logs. This age necessitates a re-interpretation of the geology of the area. Physiographically the site is analogous to the Deweyville Formation which has been correlated with the Two Creeks, Wisconsin, site with an age of about 11,400 years. This site is lower than the Prairie Formation, but may be a part of it. However, the latter formation is supposed to have originated between the Early and Late Wisconsin glaciations. The C^{14} age suggests this material may be pre-Wisconsin.

BROWN, J. S. *See* FRENCH, C. S., *et al.*

BROWN, REBECCA. Transvaal Chamber of Mines Timber Research Laboratory, Johannesburg. *Sporotrichosis in Mines of the Witwatersrand.* The largest epidemic outbreak of sporotrichosis ever recorded anywhere in the history of the disease occurred in a few mines of the Witwatersrand, when approximately 3,000 underground workers became infected within the course of two to three years. The Timber Research Laboratory of the Transvaal Chamber of Mines isolated *Sporotrichum schenckii* over sixty times from sound, untreated timber and once only from wood decayed by *Coniophora cerebella.* The triangular shape of the mature spores of the Witwatersrand strain provided a valuable clue in the search for the pathogen, for microscopic examination of material collected underground immediately confirmed the presence of the *Sporotrichum* when these spores were detected in the mounts. Once timber was found to be a source of infection, successful control measures were instituted by the introduction of treated timber and by spraying laggings in affected areas with chemicals proved experimentally to be toxic to the pathogen. Studies were carried out to ascertain the factors governing the saprophytic existence of *S. schenckii* under mining conditions. It was found to be one of the organisms occurring early in the succession of fungi appearing on timber, and to be subsequently eliminated by most of the wood-destroying fungi commonly occurring in the Witwatersrand mines.

Brown, Stewart A., G. H. N. Towers, and D. Wright. National Research Council of Canada. *The Formation of Coumarin and Related Phenylpropanoid Acids in Hierochloë odorata.* Tracer studies with carbon-14 have provided evidence that sweet grass (*Hierochloë odorata*) forms coumarin from phenylpropanoid intermediates arising via the shikimic acid pathway, and not by the condensation of acetate units. *o*-coumaric acid and its glucoside melilot side, and melilotic acid, which are structurally related to coumarin, also occur in this species, and their formation from the same precursors has been the subject of parallel studies. Changes in the distribution of carbon-14 among these products after varying times of metabolism in the presence of labeled cinnamic acid have also been determined. The results of these experiments have permitted conclusions to be drawn about the metabolic interrelationships of coumarin and the *o*-hydroxylated phenylpropanoid acids, and suggest a relation of these compounds to such metabolic processes as lignification.

Brown, Thomas E. C. F. Kettering Foundation, Yellow Springs, Ohio. *Anaerobic Uptake of $C^{14}O_2$ by Manganese-deficient and Normal Chlorella pyrenoidosa.* The uptake of $C^{14}O_2$ by manganese-deficient and normal *Chlorella pyrenoidosa,* under anaerobic conditions, will be compared to earlier work on uptake under aerobic conditions. Additional comparisons will be made between uptake by autotrophically and heterotrophically grown cells. It was found that $C^{14}O_2$ uptake under anaerobic conditions was independent of manganese. These findings will be discussed in relation to the function of manganese in green plants.

Brown, Walter V. University of Texas. *Apomixis in the Grass Subfamily Panicoideae.* Within the last 12 years apomixis (agamospermy) has been reported in over 50 species of 22 genera in 6 tribes of the grass subfamily Panicoideae. With few exceptions the apomictic process is apospory involving peculiar

4-nucleate embryo sacs. It is almost certain that many more species in this subfamily will be characterized as apomictic in the future. It is proposed that the same genes for the various aspects of the apomictic process are widespread among the genera of this subfamily and have been so since before its diversification into tribes (throughout the Cenozoic era). Both apomixis and polyploidy have been and are important in the evolution of species in these genera and agamic complexes are common. The distribution of apomixis in the eastern and western hemispheres may be related to period of occupancy. The Paniceae, an "old" tribe in both hemispheres, has numerous apomictic species in both. The Andropogoneae, a tribe best represented in the eastern hemisphere where it probably originated, has all known apomicts there except one species common in both. It is possible that the Andropogoneae reached the Americas as sexual forms and have not been in the New World long enough to have evolved balanced apomictic systems.

BROWN, WALTER V. University of Texas. *Grass Leaf Anatomy: Its Use in Systematics.* Arrangements of tissues within grass leaves are strikingly diverse among major taxonomic groups. The tissues that are most different among taxa are: the mestome (endodermal) and parenchymal sheaths and the mesophyll. The endodermal sheath is present in most grass groups except the Paniceae, Arundinelleae, Andropogoneae, and Maydeae. The parenchyma sheath is at most weakly developed and unspecialized in all of the Festucoideae. It is somewhat more specialized in such tribes as the Bambuseae, Unioleae, Oryzeae, Arundineae, and Stipeae. In the Panicoideae the parenchyma sheath cells are enlarged and specialized. In *Aristida* there are two parenchyma sheaths. Correlated with the specialization of the parenchyma sheath is a striking modification of the mesophyll. The unspecialized parenchyma sheath of the Festucoideae is associated with a spongy mesophyll having abundant air spaces and starch synthesis. The specialized parenchyma sheath of the Eupanicoideae is correlated with a more regularly arranged mesophyll, the cells of which do not store starch. In the Chloridoideae the cells external to the parenchyma sheath are radially arranged and have more or less lost their chlorophyll.

BRYANT, T. R. *See* RILEY, HERBERT P.

BUBAR, J. S. Macdonald College of McGill University, Quebec. *Self-sterility and Self-incompatibility in Lotus corniculatus L. Lotus corniculatus* (Broadleaf Birdsfoot Trefoil) is self-sterile and it possesses a genetic self-incompatibility system which serves as an effective outbreeding mechanism. Self-incompatibility is expressed through retarded pollen-tube growth rates, not by complete inhibition. Retarded growth alone encourages cross-fertilization because a stigmatic membrane is present which is ruptured by the pollinator to ensure that cross- and self-pollen starts to grow at the same time. This system is not a direct cause of self-sterility. Self-sterility appears to be caused by post-fertilization abortion phenomena such as somatoplastic sterility. The genetic cause of self-sterility involves polygenes and heterosis while self-incompatibility probably involves major "S alleles." The genetic mechanisms controlling self-sterility and self-incompatibility are probably independent; hence the plant breeder should be able to select self-fertile lines which will still possess an effective self-incompatibility crossing mechanism. Once the serious problems of inbreeding depression are overcome, it should be possible to produce inbred lines for recombination into commercial hybrids following the hybrid maize model using self-incompatibility to ensure that a high proportion of the seed produced is of the desired hybrid constitution.

BUBAR, J. S. *See* CALLEN, E. O., *et al.*

BUCHINGER, MARIA, and C. E. SUTTON. Administración Nacional de Bosques, Buenos Aires. *Preliminary Map, Indicating the Actual Vegetation of Misiones (Argentine).* Misiones, a province in the northeast of the Argentine Republic, presents a very complex vegetation. Elements of the South Brazilian forest and savanna zone are present, as well as others belonging to the Mesopotamic park. The National Park around the famous Iguazú falls with its special local climate has a corresponding vegetation. Some parts of the province are still unexplored and the flora in general is far richer than that of any other part of the Argentine. There are large areas suitable for cultivation of citrus fruits, yerba maté, tea, tung, etc., and important plantations are already in production. Also timber production is on a big scale and, in order to assure a wood supply, large forestry projects are being undertaken (*Araucaria, Eucalyptus, Pinus* plantations). In preparing the map the authors applied—where possible—Gaussen's principles. The delimitation of vegetation in unexplored areas was made according to air observations and air photographs.

BUCHLOH, GÜNTHER. Universität Bonn. *Elektronenmikroskopische Untersuchungen über Entwicklungsmodus und Histochemie der Cuticula von Apfelfrüchten.* Die Cuticula von Apfelfrüchten zeichnet sich im Verlauf der Fruchtentwicklung nicht nur durch Zunahme ihrer Stärke, sondern durch deutliche Veränderungen in ihrer chemischen Komposition aus. Diese Veränderungen treten vor allem dann auf, wenn die Früchte aus dem präklimakterischen in den klimakterischen Zustand übergehen. In diesem Stadium erreichen sie auch die grösste Massenstärke ihrer Cuticula. Im lichtmikroskopischen Bild erscheint die Cuticula auf allen Entwicklungsstadien, trotz ihrer chemischen Heterogenität, stets als nicht strukturierte, vollständig homogene Schicht. Mit Hilfe elektronenmikroskopischer Untersuchungen lässt sich dagegen nachweisen, dass die Cuticula eine Feinstruktur besitzt, die sich im Verlauf der Fruchtentwicklung zunehmend differenziert. Durch die Möglichkeit, einzelne Cuticula-Komponenten mit Hilfe von geeigneten Schwermetall-Reagenzien bei gleichzeitiger Fixierung der einzelnen Entwicklungsstadien identifizieren zu können, eröffnet einen tieferen Einblick in den Entwicklungsmodus der Cuticula und in die topographische Verteilung einzelner Komponenten in Verbindung mit der Fruchtentwicklung und mit charakteristischen Zustandsänderungen des Reifestoffwechsels der Früchte.

BUKOVAC, M. J. *See* WITTWER, S. H.

BURR, GEORGE O. Experiment Station, Hawaiian Sugar Planters' Association, Honolulu. *Growth and Yield of Sugar Cane as Influenced by Nitrogen.* In a recent series of experiments the effect on sugar cane of amounts and time of application of nitrogen was studied in great detail. Amounts of added nitrogen ranged from zero to 600 lb. per acre. The time of application ranged from all in the first month to three-quarters of the total by the thirteenth month. The cane was harvested when it was 24 months old. Samples for tissue analysis and growth rates were taken every few months. The stalks and tops were subdivided into numerous parts and analyzed for total and soluble N, total P + K, as well as moisture, reducing sugars, and sucrose. The relation of nutrient concentrations to growth and yield of cane and sugars will be shown in tables and graphs. One outstanding result is that yield is determined almost entirely by amount of N and is independent of time of application over a wide range. Critical levels of nitrogen in several parts of the plant will be discussed.

BURRIS, R. H. *See* BERGERSEN, F. J., *et al.*

BURSTRÖM, HANS. University of Lund, Sweden. *Auxins and the Growth of Roots.* Three questions about auxin to be answered are: (1) does auxin promote root growth, and, if so, how; (2) how does auxin inhibit root growth; and (3) are auxins natural root-growth regulators? Mainly with reference to my own investigations, the answers may be as follows. (1) Auxins applied externally promote cell elongation regularly when there is a Ca-deficiency and treatment is prolonged. This elongation is explained as due to an increased plasticizing of the walls, which initiates growth and becomes limiting under such conditions. (2) Inhibition depends upon a disturbance of the organization of new cell-wall material deposited after the plastic stretching. Great inhibitions occur without changes in amount of cell-wall material, and it is concluded that only the pattern of organization of the wall is altered. Observations support the assumption that the general difference between root and shoot response to auxin may depend upon whether the plasticizing, or the wall deposition, is the rate-limiting step. The common trend in auxin actions (plasticizing, wall deposition, permeability, mitoses) seems to be toward changes in colloidal structures. (3) There are no definite proofs that auxins normally limit root elongation; neither the results with antagonist nor the results with light sensitivity of roots are conclusive.

Burton, J. C. Nitragin Company, Milwaukee, Wisconsin. *Selection, Propagation and Practical Use of Rhizobial Cultures in the United States.* Cultures of rhizobia are used extensively in the United States to enhance growth and increase yields of important leguminous species. Special attention is given to strain selection, host specificity responses, and plant grouping for inoculation purposes. The various steps used in a large-scale production of rhizobial cultures and seed application methods are described. Mass production of rhizobia is achieved by using a submerged culture technique in 400-gallon fermentors. Finely pulverized heat-treated peat neutralized with calcium compounds serves as the carrier. Increases in yield attributable to seed treatment with rhizobia vary widely throughout the United States depending upon soil conditions, plant species, strains of rhizobia, and other factors. Amounts of nitrogen fixed range from 50 to 200 pounds per acre per year. Yields are often increased more than 100 per cent in low nitrogen soils. Typical effective and ineffective patterns of nodulation under field conditions are discussed. It is estimated that leguminous plants with the aid of rhizobia fix almost three times as much nitrogen in the United States as do the chemical fertilizer plants. Each phase of the discussion is illustrated with color slides.

Butler, Warren L. U.S. Department of Agriculture. *A Spectrophotometric Investigation of Intact Seeds during Germination.* Absorption spectra of intact seeds, such as lima beans and peanuts, have been obtained with a single-beam spectrophotometer capable of accommodating dense, light-scattering samples. These spectra reveal the presence of a carotenoid pigment, cytochromes a, c, and perhaps b, an unknown component which is probably peroxidase or catalase, and the protochlorophyll-chlorophyll system. Changes of these components during the early stages of germination have been followed by obtaining spectra of the intact seeds before and at various times after imbibition of water. These spectra show changes of the absorption bands ascribed to cytochromes during the early stages of imbibition: the synthesis of a carotenoid pigment about one day before emergence of the radicle and the synthesis of protochlorophyll about one day after emergence. Other spectral changes which may be associated with peroxidase also occur and will be discussed.

Butt, V. S. Oxford University. *The Distribution of Ascorbic Oxidase during Growth.* From studies of the distribution of ascorbic oxidase (AAO) between cell-wall fraction (CW), sedimentable at 500xg, and supernatant in homogenates of various plant tissues, it has been found that high proportions of the unbound enzyme are a feature only of rapidly growing tissues; in more mature tissues, most of the activity is associated with the cell wall. The distribution in pea roots and pea stems has been analysed in some detail. Segments of pea root show large proportions of soluble enzyme early in extension, but the CW fraction becomes progressively more important to attain a steady value when extension ends. During growth in segments, excised from the rapidly extending zone, there is no net increase in AAO activity, but the CW fraction becomes enriched proportionately with the extension. Growing pea stems show a similar pattern of distribution along their length. Stem sections extending under 3-indolylacetic acid (IAA) treatment show redistribution of the enzyme in favour of the cell wall at the expense of the soluble fraction, as extension proceeds. The data suggest successive synthesis of soluble enzyme and its association with the wall

during extension. It seems unlikely that either is directly affected by IAA action in excised stem sections.

Buvat, Roger. Laboratoire de Botanique, Paris. *Esquisse historique des conceptions de la structure du protoplasme.* R. Hooke crée le terme de "cellule" en 1667; l'importance de sa découverte ne se révèle que plus d'un siècle après cette date. Mirbel (1809) expose une conception "tissulaire" de la matière vivante, mais la "théorie cellulaire" ne se fait jour qu'à la suite des publications de Schleiden et de Schwann. Le contenu cellulaire est d'abord négligé, mais Dutrochet (1824) montre que là est la véritable matière vivante. La structure du protoplasme est précisée peu à peu et d'abord les structures nucléaires (R. Brown, Hofmeister, Von Mohl, Schneider, Strasburger). Ce n'est qu'après 1890 que les constituants figurés "classiques" du cytoplasme végétal sont correctement observés et interprétés (Altmann, Schimper, Meyer, Meves, Guilliermond, *et al.*). L'étude plus précise du comportement des structures visibles au microscope n'a permis qu'assez récemment de faire de la cytologie une base utile aux études physiologiques et biologiques (génétiques entre autres). Après une période de stabilité relative, où les progrès essentiels sont d'ordre biochimique, un nouvel essor résulta de l'emploi du microscope électronique: étape vers l'étude de la "cytologie macromoléculaire."

Buvat, Roger. Laboratoire de Botanique, Ecole Normale Supérieure, Paris. *Les Infrastructures du cytoplasme végétal.* Les techniques d'application du microscope électronique à la cytologie végétale sont encore très rudimentaires. Toutefois elles ont permis: (1) de retrouver chez les plantes des structures qui n'étaient démontrées que chez les animaux (dictyosomes, orgastoplasme); (2) de préciser l'interprétation des éléments figurés et les rapports entre les diverses catégories d'organites; et (3) de confirmer l'importance des surfaces dans l'activité physiologique des cellules vivantes. Les caractères morphologiques des divers constituants seront décrits, ainsi que les faits actuellement acquis sur leur genèse et leur comportement au cours de la différenciation cellulaire.

Buxton, E. W. Rothamsted Experimental Station, Harpenden, England. *Factors Affecting Pathogenic Fusarium oxysporam in the Rhizosphere of Peas.* Exudates from roots of three pea varieties that differentiate between three physiologic races of *Fusarium oxysporum* f. *pisi* (the cause of pea wilt) affected spore germination in the three races in different ways, depressing germination of races which the varieties resisted, and increasing germination of those to which they were susceptible. Variety Onward, susceptible to race 1, supports more fungi, bacteria, and actinomycetes near its root surface than do either Wilt-Resistant Alaska or Delwiche Commando, which resist race 1. Water extracts of the three rhizosphere soils affected the germination of spores of the three physiologic races of the *Fusarium* in the same way as did root exudates from the three varieties. Plants became severely wilted in soil in which Onward had grown and in control soils which had not grown peas, but wilting was less and developed more slowly in soil previously cropped with varieties W. R. Alaska and Delwiche Commando. Twelve out of 121 cultures of 55 different species of fungi and bacteria isolated from the rhizosphere of peas strongly inhibited growth of *F. oxysporum* f. *pisi* in agar media. The inhibitory effect of nine of these was greatly increased when they were cultured in a medium containing pea-root

exudate and further increased when the medium also contained soil extract. It is suggested that substances exuded by roots of pea varieties resistant to race 1, in addition to altering the composition and metabolic activity of the rhizosphere microflora, prevent race 1 from germinating, thus lowering the amount of effective inoculum and decreasing the severity of wilt.

Buxton, E. W. Rothamsted Experimental Station, Harpenden, England. *Mechanisms of Variation in the Pathogenicity of Fusarium oxysporum. Fusarium oxysporum*, the cause of many vascular wilts, is a highly variable fungus, despite the fact that it has no known sexual stage. Like many other *Fungi Imperfecti*, its pathogenicity can change as a result of several asexual mechanisms of genetic variation. The most important of these are heterokaryosis, parasexuality, and adaptation. Some isolates of *Fusarium* from peas initially unable to cause wilt became able to do so when associated together as heterokaryons, presumably as a result of complementary action between genes in the separate haploid nuclei. Parasexuality occurred in heterokaryons composed of genetically different nuclei that controlled either race 1 or race 2 pathogenicity in *F. oxysporum* f. *pisi*. The probably diploid nuclei that occurred in the heterokaryons not only segregated to their original components, but also recombined for cultural, biochemical, and pathogenic factors. Some of the recombinant progeny wilted pea varieties that were resistant to races 1 and 2, and so could be classified as new physiologic races. Adaptation occurred in response to root exudate from pea varieties resistant to race 1. The roots of wilt-resistant peas produced substances that prevented *Fusarium* spores from germinating in the rhizosphere. However, when spores were retained in the root exudate, or were successively transferred through a series of increasing concentration of exudate, they became tolerant to it, and later caused wilt in the previously resistant varieties. Whether these changes resulted from mutation, followed by selection in the exudate, or from enzymatic adaptation, is not yet clear.

Byerrum, R. U., and T. Griffith. Michigan State University. *Studies on the Biogenesis of the Pyridine Ring of Nicotine.* Previous experiments in our laboratory have shown that acetate-1-C^{14} and acetate-2-C^{14} are utilized by *Nicotiana rustica* to produce radioactive nicotine. Acetate-1-C^{14} was incorporated into nicotine with a dilution (specific activity of precursor/specific activity of nicotine) of about 950 whereas acetate-2-C^{14} was introduced with a dilution of 450. Partial degradation of nicotine from plants fed acetate-1-C^{14} showed that only 4 per cent of the total radioactivity of the alkaloid was in the pyridine ring whereas nicotine from plants fed acetate-2-C^{14} had 48 per cent of the radioactivity in the pyridine ring. In considering possible routes for the biosynthesis of the pyridine ring from acetate and from other compounds, it seemed possible that three-carbon compounds might be intermediates. Consequently, propionate-2-C^{14} and glycerol-1, 3-C^{14} were administered to separate groups of three-month-old *Nicotiana rustica* in nutrient solution. The compounds were fed a small volume of solution which allowed for complete uptake within four to five hours. After the plants had metabolized one of the labeled compounds for a week, nicotine was isolated as the dipicrate and measured for radioactivity. Nicotine from plants fed labeled propionate or glycerol was radioactive and the dilution was about 200 for propionate and 140 for glycerol. A partial degradation of the nicotine from plants fed propionate-2-C^{14} showed that 48 per cent of the radioactive carbon in the molecule was in the pyridine ring whereas 68 per cent was in the pyridine ring after feeding glycerol-1, 3-C^{14}. Further degradation of the pyridine ring is in progress to determine the exact location of radioactive carbon after feeding the labeled precursors. A possible mechanism for incorporation of acetate, propionate, and glycerol into the pyridine ring of nicotine will be discussed.

BYRDE, R. J. W. University of Bristol. *Eradicant Fungicides.* Eradicant ("contact") fungicides are compounds applied externally to the host to kill a pathogen already present on or within it. The ultimate success or failure of such a treatment depends on the ability of the pathogen to build up rapidly from that part of the inoculum which, in practice, inevitably escapes. Among factors favouring such a recovery are the ability to infect over a long period, a short generation time, and the production of wind-disseminated spores. Diseases for which eradicant fungicides have given some control include blossom wilt of stone fruit (*Monilinia laxa*), peach leaf-curl (*Exoascus deformans*), apple scab (*Venturia inaequalis*), pecan scab (*Cladosporium effusum*), apple canker (*Nectria galligena*), and pear block spot (*Alternaria kikuchiana*). The compounds generally used are organo-mercurials, strongly acidic phenols, or arsenicals. These materials probably have the ability to react irreversibly with fungal constituents, and are not readily inactivated by other organic matter. Such reactivity is generally associated with high phytotoxicity, necessitating use at critical concentrations or, more commonly, in the dormant season. Generally, eradicants are used only against diseases not readily controlled by protectant fungicides. Conventional experimental layouts, involving replicated and randomized control plots, are unsuitable for field tests of eradicant fungicides.

CAIN, ROY F. University of Toronto. *The Plectascales and Perisporiales in Relation to the Evolution of the Ascomycetes.* The Plectascales and Perisporiales include species with a great diversity of structure and many different orders are represented instead of two. These fungi do not represent primitive Ascomycetes but have evolved from various orders such as Pezizales, Hypocreales, Helotiales, Sphaeriales, and Pleosporales. There has been an evolution in the direction of: (1) evanescent asci replacing those with forcible discharge, (2) globose asci, (3) absence of ostiole, (4) peridium of hyphae instead of pseudoparenchyma cells, (5) absence of peridium, (6) irregular disposition of asci, and (7) absence of paraphyses. Genera such as *Amauroascus, Gymnoascus, Anixia* and *Monascus* have evolved from the Pezizales and all lack phialides. In contrast to these there is a group of genera including *Byssochlamys, Emericellopsis, Aspergillus, Penicillium, Emericella, Sartorya, Talaromyces, Eurotium,* and *Carpenteles* which have phialides with the more highly evolved dry chains of phialospores and elaborate phialophores. These are in part connected with the Hypocreales and in part with such genera as *Trichocoma* and *Penicilliopsis*. In the following list brackets indicate related genera: (*Nectria, Heleococcum*), (*Melanospora, Microthecium*), (*Chaetomium, Chaetomidium, Kernia*), (*Ceratocystis, Europhium*), (*Podospora, Tripterospora*), (*Gelasinospora, Anixiella,* undescribed genus), (*Coniochaeta,* undescribed). In the *Loculoascomycetes, Sporomia* and *Trichodelitschia* have given rise to *Preussia* and *Phaeotrichum* respectively.

CAIN, STANLEY A. University of Michigan. *Strength and Weakness of the Ecological Approach to Conservation.* The principles and methods of ecology form the core of the scientific basis for the conservation and management of renewable natural resources. Ecology has less to offer directly to the details of management of non-renewable natural resources, yet the ecological concentration of interest on inter-relations is indispensable to integrated resource management, as on watersheds or other land units. Conservation, however, far transgresses the limits of the direct, specific, science-based technologies and gets involved with all the societal forces — economic, political, social, legal, etc., that is, deep in culture. It is at the level of human ecology, when the concern is with the management of process in the ecosystem, that some of the traditional concepts and methods of ecology become inadequate and at times even misleading.

CALDER, JAMES A. Plant Research Institute, Ottawa. *Some Post-Pleistocene Migration Routes and Distribution Patterns in British Columbia.* Recent surveys and studies of the flora of British Columbia have clearly shown the significance of this area for interpreting the various aspects of post-Pleistocene plant migration. It is an area that was almost completely glaciated in the late Pleistocene. The furthest southward advance of the ice sheet extended from near the Canadian–United States border to a depth of about 200 miles in western Montana and Washington. To the north there were extensive refugia in Alaska, the Yukon, and possibly also in the mountain ranges of the western Mackenzie District. There was also a small but significant refugium in the mountainous regions of the Queen Charlotte Islands. Such an area with a diversified topography, extremes in climatic conditions, unglaciated territory to the south, and refugia to the north and on the west is ideally situated for phytogeographic studies. The various migration routes and major plant distribution patterns are indicated on a series of wall charts. These are supplemented by maps showing the topography, surface and glacial geology, biotic and climatic regions, etc.

CALLAHAM, ROBERT Z. Spokane, Washington. *Experimental Taxonomy—More than Seed Source Studies.* Defining the local or best seed source is a key problem faced in every program to improve forest trees. Whether hybridizing or selecting, the tree improver must know the characteristics and the extent of local populations. The earliest seed source studies set the forester's pattern for experimental study of this variation. Physical and biological limitations, high costs, and the long wait for results all tend to reduce the fact-finding efficiency of this traditional approach. New methods of experimental taxonomy need to be brought in. New understanding of physiology, biochemistry, genetics, and comparative cytology and morphology must be applied in foresters' investigations of variation. New approaches as applied in our studies of ponderosa pine can lead quickly and more efficiently to resolving the patterns of variation in question. Tests of new methods will show the comparative utility of a method of study for resolving each problem, and they will illuminate characters definitive in understanding each pattern of variation. Then, the most promising leads can be applied in extensive studies of variation in widespread species. Simultaneous studies using several definitive tests will be most fruitful; patterns for several characters probably will be necessary to piece together complex geographic variation.

CALLAHAM, ROBERT Z. Spokane, Washington. *Temperature and Seed Germination for Races of Ponderosa Pine.* Half-sib progenies from twenty sources were germinated at five constant temperatures. The sources sampled much of the range of ponderosa in the western United States. Rates of germination were determined at 8°, 16°, 24°, 30°, and 36° C. Significant regional and local differences in germinative energy and germinative capacity were readily detected at most temperatures. The interior sources, particularly those from Nebraska, germinated most rapidly at all temperatures. Most of the interior sources showed optimum germinative energy at lower temperatures than coastal and Pacific Northwest sources. Germinative capacity of nearly all sources was severely reduced at the highest temperature.

Callen, E. O., J. S. Bubar, and W. F. Grant. Macdonald College of McGill University, Quebec. *Studies in the Genus Lotus (Leguminosae).* The Brand monograph (1898) excluded all North American species (*Hosackia* Dougl.), as well as *Tetragonolobus* L., *Dorycnium* Vill. and *Bonjeania* Lowe of the Old World. The authors exclude the latter two, but include *Hosackia* and *Tetragonolobus*, and agree with Brand in using the style to separate subgenera, instead of varying combinations of leaf, stem, flower, and pod of recent workers. Four subgenera have been proposed (Callen, 1959): (1) *Pedrosia* (Lowe) Brand, (2) *Edentolotus* Brand, (3) *Deflectostylus* Callen, and (4) *Tetragonolobus* (Scop.) Lam. et DC. Chromosome number determinations from literature and by Grant and Bubar (unpublished) show that all species in the subgenus *Pedrosia* have a count of $2n = 14$, with a single species $2n = 28$, in *Edentolotus* $2n = 12$, 14, 24, and 28, in *Deflectostylus* $2n = 12$ and 14, and in *Tetragonolobus* $2n = 14$. Of special note: the North American species have a $2n = 12$ group, just as the Old World ones, but there is an absence of tetraploids, with possibly a single exception; the two native Australian species are tetraploids with $2n = 28$. Using gross morphological characters and time of flowering, attempts are being made to classify the many cultivars and varieties within the *L. corniculatus* complex (a very widely distributed species).

Calvin, M. *See* Park, R. B., *et al.*

Campbell, J. B. *See* Lodge, R. W., *et al.*

Campbell, John D. Research Council of Alberta. *The Ardley Coal Micro-Flora, Uppermost Cretaceous, Central Alberta, Canada.* The youngest of the Cretaceous beds in the Red Deer Badlands region of Central Alberta is the Upper Member of the Edmonton formation, believed to be Danian in age. A prominent feature of this member is the 30-foot-thick complex of black shales and coal bands, often commercially important, known as the Ardley Coal Seam, perhaps better referred to as the Ardley Coal Zone. Using chiefly outcrop specimens, but also to a limited extent sub-surface oil-well samples, this paper examines the spore and pollen flora of the Ardley Zone over an area some 65 miles north and south along the outcrop and about 50 miles westward down-dip. Stratigraphical features are related to observed floral variations.

Campbell, W. A. University of Georgia. *Littleleaf Disease of Shortleaf Pine (Pinus echinata Mill.): Present Status and Future Needs.* Littleleaf disease investigations carried on since 1940 by the U.S. Forest Service and affiliated agencies have demonstrated that the soil fungus *Phytophthora cinnamomi* can attack the tips of extending and short roots of shortleaf pine causing decline and death of affected trees, especially on soils with poor internal drainage. Soils and sites have been evaluated from the standpoint of disease hazard. Nitrogen fertilization will protect high value trees, and cutting methods have been formulated for minimizing losses in forest stands. Present research is directed at the selection of disease-resistant shortleaf pines from severe littleleaf areas and the testing of their progeny for disease resistance and other desirable characters. Better methods of testing seedlings for resistance to *P. cinnamomi* are under study. Future plans include the production of seed from controlled pollinations, the testing of the seedlings for resistance to root damage by *P. cinnamomi*, and the outplanting of promising individuals to littleleaf sites for evaluating ultimate performance. Soil rehabilitation studies are under way on the more impermeable "littleleafy" soils to test the effects of increasing the proportion of soil-building hardwoods on *P. cinnamomi*, on soil characteristics, and on freedom from littleleaf.

CANRIGHT, JAMES E. Indiana University. *Phylogenetic Importance of the Stamens and Pollen of the Annonaceae.* Considerable morphological variation exists among the stamens and pollen of this large pantropical family. Earlier taxonomic treatments place considerable emphasis on the multiplicity of stamen types, and especially the "connective appendages," in delimiting annonaceous tribes and genera. The production of transverse septa in the anthers of some genera (e.g., *Xylopia, Cardiopetalum*) is another feature of phylogenetic significance. The pollen is monocolpate (rarely acolpate) with an irregularly defined germinal area on the *proximal* surface, whereas other ranalean families are commonly characterized by distally colpate pollen grains. Exine sculpturing varies from psilate through various grades of verrucate, reticulate, and even echinate elements. Pollen shed in coherent tetragonal tetrads is a relatively common feature in a number of genera, but coherent tetrahedral tetrads are comparatively rare in this family.

CARLES, JULES. Institut Catholique, Toulouse. *Les Conditions physiologiques de la verse du blé.* Le manque de résistance de la partie basse des chaumes du blé est la conséquence d'un déséquilibre nutritif, d'un trouble survenu dans le rapport glucides/protides ou C/N. Le carbone provient de la photosynthèse et son accumulation dans la plante dépend de la lumière et du temps d'insolation; l'azote provient du sol et des engrais. Les glucides sont d'autant plus abondants (jusqu'à 20 fois plus) dans la tige de blé que l'azote est plus rare, tandis que les glucides sont rares quand l'azote abonde. L'augmentation d'azote entraîne: (1) une rapide utilisation des glucides surtout dans les extrémités (proportion limbes/gaines beaucoup plus grande); (2) une modification de la croissance qui se poursuit plus longtemps, attend plus longtemps la consolidation finale — les entre-nœuds avec azote augmentent encore leur poids quand les autres commencent déjà à baisser. Pour mettre le blé dans les conditions rendant possible la verse, il suffit de diminuer, par un procédé quelconque, l'insolation, jusqu'au point où l'absorption du carbone devient trop faible par rapport à l'absorption d'azote.

CARLQUIST, SHERWIN. Rancho Santa Ana Botanic Garden, Claremont, California. *Handling the Anomalous Genus.* The use of plant anatomy may be of critical importance in establishing taxonomic position and evolutionary relations of genera (or other taxa) which have seemed of uncertain affinities. The use of anatomical data by the systematist requires understanding not only of terminology, but also of the variation pattern and significance of structural features. The anatomist must be resourceful in using the taxonomic system for the selection of materials, and must understand the gross morphology of the plants he studies. Principles in the investigation of anomalous genera, such as initiative in discovering unsuspected relations, use of a wide gamut of anatomical (and other) features, and use of herbarium material for anatomical studies, are described. Examples of studies of genera in which such principles have been embodied, such as those of *Degeneria* and *Heteropyxis*, are analyzed. With the aid of color slides, the author compares a variety of features of the genus *Argyroxiphium* ("silversword") with those of its probable closest relatives.

CARMICHAEL, J. W. University of Alberta. *Keratinophilic Molds from Alberta Soils.* Keratinophilic molds have been isolated from various types of habitats by placing keratinaceous baits on the surface of moistened samples. Some of the keratinophilic fungi are closely related to the dermatophytes; others are Ascomycetes, Hyphomycetes, or Actinomycetes. Interesting Zygomycetes also appear in the cultures. The appearance of the more common keratinophilic fungi is depicted along with some of the other distinctive molds encountered.

CARNS, H. R., J. L. MCMEANS, U.S. Department of Agriculture; and F. T. ADDICOTT, University of California. *An Abscission-accelerating Hormone in Cotton and Some of Its Interactions with Auxin and Gibberellic Acid.* An abscission-accelerating substance has been obtained from young, abscissing cotton fruit. The physiological properties of the substance indicate that it should be classed as a hormone. It can be obtained from fruit by diffusion into agar or by extraction with ether. Reapplied to young fruit or to debladed petioles, it accelerates abscission. Applied to *Avena* coleoptiles, it inhibits 3-indoleacetic acid induced curvature and straight growth responses. More of the hormone can be obtained from fruit of varieties of cotton which normally abscise a high percentage of young fruit than from varieties which normally abscise only a low percentage of young fruit. Tests indicate that the hormone is not an indolyl compound, that it contains no nitrogen, but that it probably contains a carbonyl group with one or more adjacent hydroxyl groups. Some physiological interactions of the hormone with auxin and with gibberellic acid on the process of abscission will be reported.

CARR, D. J. University of Melbourne. *Translocation between Leaf and Meristem in the Flowering Response of Short-day Plants.* The product (P) of an inductive long dark period (LDP) is exported from the leaf of a short-day plant along with sugar (Carr, 1957). The leaf may be removed after export has finished without affecting the final flowering response. P is unstable in the rest of the plant and is imported into, and probably transformed in, shoot apical meristems (S.A.M.). The transformed and stable product ("flower hormone," FH) may be summated in S.A.M., but transformation, and hence summation, are antagonized by long days, probably via gibberellin production. When a critical level of FH is reached flowers are initiated. In some plants (e.g., *Xanthium*), an initial supply of FH triggers off further production in the S.A.M. which are fully autonomous in this. We (unpublished) have grown in sterile media excised

S.A.M. from plants treated with three LDP's; within one month they have flower primordia. Apices from non-treated plants remain vegetative. In other plants (*Kalanchoe*, soybean), further production of FH in S.A.M. can result only from importation of more P. Leaves exposed to a few LDP's continue to produce P even in LD, but rate of production declines to zero in a few hours (probably) in *Xanthium*, in a few days (after ten LDP) in soybean (unpublished grafting experiments) (and Perilla?). This may explain why it is possible to "induce" Perilla leaves with, say ten LDP, but not *Xanthium*. We need to know more about what happens to a *Xanthium* leaf after flowering starts. A leaf from a plant previously treated with one LDP and now in full flower is effective as a donor. But a leaf removed immediately after one or two LDP is ineffective (unpublished) (cf. Lona's work on secondary induction — still not critically tested — and Sachs' on *Cestrum nocturnum* (LD-SD plant)). A *Xanthium* leaf treated with LDP suffers a change by which it can become a donor when the plant flowers ("feed-back" from the floral meristems?).

CARTWRIGHT, PHYLLIS M. University of Reading. *The Growth and Nodulation Pattern of Leguminous Plants as Influenced by Combined-nitrogen Supply, Light Intensity, and Daylength.* A high level of combined nitrogen in the nutrient medium depresses root-nodule formation in leguminous plants. It is shown that the magnitude of this effect depends on other environmental factors particularly those, such as light, which influence the supply and rate of utilisation of carbohydrate. A study has been made of the influence of light, in terms of both intensity and daylength, on the nodulation of several leguminous species grown under different nitrogen régimes in sand culture. Differences in the light intensity and nitrate level markedly influenced the growth and nodulation pattern of field beans (*Vicia faba*) and soya beans (*Glycine max*). With field beans increase in nitrate level had an inhibiting effect, whereas increase in light intensity resulted in greater development of nodules on the primary root. Daylength did not influence the growth habit or the nodulation of red clover (*Trifolium pratense*); but in long days lucerne (*Medicago sativa*) showed more erect growth, greater internode extension, and, at low nitrate levels, fewer nodules than in short days. The reduction in nodulation may be correlated with a greater rate of carbohydrate utilisation in the extension growth of the shoot.

CASSIE, VIVIENNE. Oceanographic Institute, New Zealand. *Ecology of Marine Algae.*

CATHEY, HENRY M. U.S. Department of Agriculture. *Differences in Growth-retardation Responses of Various Plants to Four Quaternary Ammonium Carbamates.* Four quaternary ammonium carbamates were evaluated for growth retardation of 28 kinds of plants. The compounds differed structurally in the carbamate and in the two isomeric terpene radicals as follows: piperidine carboxylate with thymol (Amo-1618) or carvacrol (69-27); dimethyl carbamate with thymol (69-23) or carvacrol (69-31). All four compounds retarded the growth of Black Valentine beans over a wide range of concentrations. This plant was relatively non-selective in response to growth-retarding chemicals. Three of the compounds retarded the growth of lima beans and chrysanthemums; 69-31 was ineffective. In contrast, only 69-27 retarded the growth of poinsettias and castor beans and 69-23 retarded the growth of marigolds and a double haploid cotton. When applied to most plants, 69-31 either was ineffective or stimulated growth. Thus, certain plants were selective in response to the combination of carbamate and terpene, while many others did not respond.

Cave, Marion S. University of California. *Embryological Characters of Taxonomic Value.* Embryological characters useful to the taxonomist are illustrated by kodachrome slides. Such criteria in angiosperms have to do with three generations in the life cycle. Not only the stamens and carpels of the diploid parent generation and micro- and megasporogenesis, but also the haploid micro- and megagametophytes, and finally the new sporophyte generation including both embryo and endosperm, are considered. Characters illustrated include: (1) anther tapetum; (2) delimitation of microspores; (3) mature microgametophyte; (4) coverings of nucellus, (*a*) number of integuments, (*b*) aril, (*c*) obturator; (5) size of nucellus; (6) persistence of nucellus; (7) nature of archesporium; (8) cover cell; (9) hypostase; (10) embryo-sac type; (11) mature megagametophyte; (12) endosperm; (13) haustoria; (14) embryo; (15) mature seed. Examples are given of the application of these criteria to taxonomic problems both within the monocotyledons and within the dicotyledons.

Celarier, Robert P. Oklahoma State University. *Cytogeography of the Old World Bothriochloeae (Gramineae).* The subtribe *Bothriochloeae* Keng of the tribe Andropogoneae is generally considered to include six genera, all with a tropical distribution. Only two, *Bothriochloa* O. Ktze, and *Dichanthium* Willomet, have more than a few described species. In both of these genera there are several groups of species that are difficult to distinguish which in this report are considered complexes. Five such complexes have been studied in some detail and are reported here. Cytological and morphological studies are reported for 75 collections of the *B. ischaemum* complex, 42 for *B. pertusa,* 27 for *B. intermedia,* 116 for *Dichanthium annulatum,* and 32 for *D. caricosum.* These collections sampled the range of distribution of each complex. *B. ischaemum* is widespread and continuous throughout warm temperate Eurasia. *D. annulatum* is continuous in distribution throughout the tropics, whereas the other three complexes are disjunct between Africa and India. Only *B. intermedia* extends to Australia. Diploids have been found only in *Dichanthium,* pentaploids only in *Bothriochloa,* but tetraploids and hexaploids are found in all complexes. Meiotic behavior is regular in the diploids, variable in the tetraploids, and extremely irregular in the others. Each complex has two or more distinct morphological types and these are well correlated with chromosome number and behavior as well as geographical distribution.

Cernohorsky, Zdenek. University of Pedagogics, Prague. *Fluorescence Analysis in the Taxonomy of Lichens.* Many lichens fluoresce when exposed to ultraviolet radiation (Cernohorsky, 1950; Ozenda, 1951). The cause of this phenomenon was explained by M. E. Hale (1956). He proved that the fluorescence of lichen thalli is conditioned by the fluorescence especially of some depsides and depsidones. This investigator found further, in agreement with Wachmeister's results (1952), that there was a correlation between intensity of fluorescence and the substituents on the acidic ring: all six intensely fluorescent depsides have 2-hydroxy, 4-methoxy configuration. Among the depsidones there are no comparable correlations between fluorescence and chemical structure.

According to Hale (1957) most anthraquinones and pulvic acid derivatives also fluoresce to some degree. The fluorescence of lichens has a restricted use in the taxonomy when the chemical components of some lichen species—similar in external appearance—are well known, one being fluorescent, the other not: *Parmelia centrifuga* and other yellow species containing alectoronic acid fluoresce, while the *P. conspersa-stenophylla* group with β-orcinol derivatives does not (Cernohorsky, 1950; Hale, 1956). According to Hale similar examples may be found in *Stereocaulon* and *Cetraria.* Analogically *Cladonia squamosa* (squamatic acid) fluoresces, while *Cl. subsquamosa* (thamnolic acid) does not (Cernohorsky, 1957).

CÉZARD, L. NARCISSE. Nancy, France. *Perspectives d'étude des excrétions racinaires.* Résumé des travaux antérieurs et des controverses sur la possibilité du rejet par les racines de matières elaborées nocives. Difficultés de prouver le fait. Travaux de L. Guyot: experimentations à l'Ecole Nationale d'Agriculture de Grignon. Incidence sur les groupements végétaux; dominances. Se garder de reporter tous les phénomènes de dominance aux seules excrétions racinaires: exemple de *Brachypodium pinnatum,* espèce non toxique. Substances inhibitrices: (1) intoxication des végétaux concurrents, (2) auto-intoxication: *Viola, Crocus, Linum*; (3) inhibition bénéfique: *Corydalis cava* sous *Aesculus hippocastanum*; (4) inhibitions parfumées: influence de *Ribes nigrum* et *Iris florentina* sur *Vitis vinifera* (Cézard et Bergeret). Exemples de végétation interrompue de certaines espèces dans les jardins botaniques anciens sont *Hyoscyamus niger* et *Lotus corniculatus.* Possibilité d'y remédier par desinfection du sol par la vapeur: roseraies de la Brie, laitue en terrains maraîchers. Perspectives d'études sur des espèces antagonistes: *Ranunculus repens/Allium divers; Phaseolus/Gladiolus; Aegopodium podagraria/Ranunculus repens.*

CHAILAKHJAN, M. CH. Academy of Sciences, Moscow. *Interaction of Plant Organs during Flowering Induction.* The flowering of plants is a result of the interaction of the three organs — the leaf, stem, and root. The leaf is the receptive organ of the photoperiodic action in all types of plant species. Changes in physiological state occur in the leaf, and under conditions of a favorable day-length the metabolites are formed which are required for flowering. The stem is the organ of translocation of these metabolites; the formation of flower organs occurs in the stem bud. Movement of these metabolites takes place in living cortical elements and can proceed in any direction from the leaf to the stem bud where the metabolites induce such metabolic changes which lead to setting of the flower organs. The root is the organ on whose metabolites stem growth and plant flowering depend. In rosette long-day species this dependence is more pronounced than in stem-forming short-day species. Many organic substances are involved in the process of flowering, but of greatest significance are flowering hormones (florigen). Florigen consists of gibberellins, which influence stem formation and growth, and anthesins which influence flower formation. Flowering induction in short-day species is related to the formation of deficient anthesins and in long-day plants to the formation of deficient gibberellins.

CHAILIKHJAN, M. KH. Academy of Sciences, Moscow. *Principles of Ontogenesis in Higher Plants.* The ontogenesis of plants has the following principal regularities. Ontogenesis, or individual development, in higher plants is divided into five successive stages: embryo, juvenility, maturity, reproduction, and senility. Each one of these ontogenetic stages has its own specific physiological properties and morphological characteristics. The motive forces of the ontogenesis of plants stem from the contradictions between rejuvenation and ageing, between vegetative growth and reproductive development. The age changes that occur in plants during ontogenesis result from the relations of the processes of rejuvenation and ageing. The principal integral processes in the ontogeny of plants are vegetative growth and reproductive development; and it should be noted that each of these processes also includes the formation of qualitatively new structures and their quantitative growth. In all its successive stages, plant ontogenesis is intimately dependent on environmental conditions. However, most essential in ontogenetic processes is the plant itself and not the environment. Plants pass through successive stages of ontogenesis with the interaction of all their parts and organs, the physiological and structural specificity of which creates potentials for intensive metabolism. Plant ontogenesis has marked adaptive features. Owing to adaptation to environmental conditions, plant species of diverse geographical origin and distribution (neutral, short-day, and long-day, spring and winter) have historically evolved morpho-physiological peculiarities.

Chaloner, William G. University College, London. *Palaeo-ecological Data from Carboniferous Spores.* As the parent plants of isolated spores become known, spore distribution in rocks of various lithology throws new light on the ecological status of these plants. An example of this is the spore distribution observed in a continuous sequence of Carboniferous non-marine shale, coal seam and marine shale (Neves, 1958). The high concentration of *Florinites* in the marine shale is most easily explained by supposing that the more or less permanent upland areas adjacent to the coal swamp basin were forested with Cordaites and conifers. Although such an upland flora may have been of considerable extent, it would be very inadequately represented among the contemporary macrofossils. The correlation of a species of *Densosporites* with a minute lycopod cone indicates that the parent plant of this and other species of this genus was either herbaceous, or at least of small size compared with the arborescent lepidodendrids. The durite bands in coal in which *Densosporites* spp. are commonly the most abundant spores would accordingly represent vegetation dominated by such herbaceous lycopods. As with upland vegetation, such herbaceous types (even in the coal swamp flora) would be poorly represented in the macrofossils. Spore studies may offer a truer picture of the real status of these under-represented components of the Carboniferous flora.

Champagnat, Paul. Faculté des Sciences de Clermont. *Particularités de l'inhibition des bourgeons sur le rameau d'un an des végétaux ligneux.* On peut admettre que le déterminisme des corrélations entre bourgeons est le même sur la pousse herbacée des végétaux ligneux et sur une plante herbacée banale. Sur le rameau d'un an, on observe, au contraire, des caractères beaucoup plus spéciaux. (1) Les influences réciproques entre bourgeons manquent totalement de polarité. (2) L'étude cinétique des levées d'inhibition met en évidence un lien avec la vigueur. Si cette dernière est insuffisante les corrélations font totalement défaut. (3) Le développement inégal des rameaux sur l'axe s'explique alors par l'existence de gradients fixés de préséances. (4) En automne, l'ntensité de dormance n'étant pas la même pour tous les bourgeons, certains sont, au printemps, "éveillés" plus tôt et peuvent inhiber le développement des autres. (5) Le gravimorphisme ajoute son effet à celui des préséances fixées en augmentant l'inégalité entre flèche et pousses latérales obliques. La mise en place de plusieurs de ces caractères s'effectue entre l'arrêt de la croissance estivale et la reprise de la végétation au printemps suivant. La présence, dans le rameau d'un an, du mécanisme fondamental qui règle les interactions entre bourgeons sur les pousses herbacées n'est cependant pas exclue.

CHAMPIGNY, M. L. Laboratoire de Photosynthèse du C.N.R.S., Gif-sur-Yvette, France. *Sur la synthèse des acids aminés dans les feuilles d'une Crassulacée, Bryophyllum Daigremontianum Berger.* Parmi les principaux acides aminés formés à l'obscurité, l'α-alanine et l'acide aspartique résultent très vraisemblablement d'une β-carboxylation initiale du ribulose diphosphate, puisque l'α-alanine est marquée essentiellement en 1 et l'acide aspartique à la fois en 1 et en 4 (il en est de même d'ailleurs de l'acide malique). Leur genèse emprunte alors le même mécanisme qu'à la lumière. La lumière accélère à la fois la synthèse des acides aminés directement liés à la fixation photosynthétique de CO_2 (α-alanine, sérine et glycocolle) et la vitesse de la β-carboxylation de l'acide phosphoénolpyruvique d'où résulte une genèse accrue d'acide aspartique, de β-alanine, de thréonine et de méthionine. L'oxydation des acides organiques accumulés à l'obscurité (malique, citrique, isocitrique) est également accélérée en présence de lumière. L'acide glutamique est alors abondamment formé ainsi que l'acide γ-aminobutyrique et l'arginine. Cette abondante formation oppose les feuilles de *Bryophyllum*, plante riche en acides, aux plantes pauvres en acides chez qui la synthèse d'acide glutamique est moins rapide à la lumière qu'à l'obscurité.

CHAMPIGNY, M. L. *See* MOYSE, A., *et al.*

CHAO, CHUAN-YING. Academia Sinica and National Taiwan University. *Heterotic Effects of a Chromosomal Segment in Maize.* The method of Dobzhansky and Rhoades for locating favorable genes by the use of paracentric inversions was adopted. A stock *In 3a* was crossed with each of fifteen inbred lines. Comparisons of agronomic characters were made within the F_2 and backcross populations. A region on chromosome 6 was also followed by means of the Y_1 locus. Genes increasing ear height are present on chromosome 6 of the *In 3a* and in the long arm of chromosome 3 in most of the lines studied. These genes do not show overdominance. Genes for earliness are present on chromosome 6 of many lines. Certain lines possess genes on chromosome 3 which give an increase in yield. However, the expression of these genes varies with genic background and environment. The *In 3a* segment contains genes for high row number while the majority of the lines possess such genes on chromosome 6. A striking correlation was observed between yield and ear number. The method of Dobzhansky and Rhoades can be used successfully to locate genes for ear height, row number, and ear number. It is less effective when applied to yield and maturity where interactions with the residual genome and the environment play an important part. (Submitted in partial fulfilment of the requirements for the degree of Doctor of Philosophy in Botany at the University of Illinois.)

CHAPMAN, HOMER D. University of California. *Evaluation of Present Diagnostic Criteria for Determining Nutrient Status of Citrus and Guidance of*

Fertilizer Practices. While leaf analysis in the present state of development and systematically followed is a powerful tool in diagnosing nutrient disorders of citrus and in helping to make differential diagnoses in cases where the visual symptomology of two different disorders is similar, any attempt at a complete assessment of nutrient status and guidance of fertilizer and soil management practices must rely also on soil analysis and other soil measurements. This paper analyzes the present status of the use of visual symptomology, leaf analysis, and soil analysis for the diagnosis of mineral deficiency and excesses. Save in a few cases, namely, zinc, manganese, magnesium, and iron deficiencies, the early stages of a nutrient deficiency and excess cannot be diagnosed by means of visual symptoms. It is in the diagnosis of the incipient stages that leaf analysis, supplemented by soil analysis, finds its greatest usefulness. In more acute stages, visual symptomology is increasingly useful, but in many instances supplemental leaf analysis is necessary. There are, on the other hand, some situations in which neither visual symptoms nor leaf analysis are useful and in these soil analysis must be used. Even here there are blind spots in our knowledge and these are the areas where much more research is needed.

Chapman, V. J. Auckland University. *The Factors Controlling the Upper and Lower Limits of Major Belt-demarcating Algae.* A full understanding of the factors controlling the limits of marine algae will only be achieved when the individual belt-demarcating species have been studied in great detail. In the case of littoral algae, tidal movement and factors associated with it must be of major importance, whilst with sublittoral algae it would seem that light requirements, either over-all or else during high water, will be of major importance, though in the sublittoral plant and animal competition may be significant. Among adults of a single species there may be different ecological forms that need recognizing so that one is certain of the investigated material. Here the use of statistical methods may be of great value. The response of a species to dessication, the effect of water loss and sea and air temperature upon respiration and photosynthesis, the effect of light during emergence and submergence upon photosynthesis, the effect of seasonal variations in the environmental climate, of variations in the tidal phenomena throughout the geographical distribution of the species upon the critical juvenile (where we have far too little information re its responses) and the adult stage must be integrated in reaching the final picture. Recent work on *Hormosira banksii* will be quoted to illustrate these points.

Chaudhri, Ikram Ilahi. University of Sind, Hyderabad. *Thermoperiodic Response in Seed Germination.* The effect of light and temperatures on seed germination of *Amaranthus fimbriatus* (Torr.) Benth., *Amaranthus viridis* L., *Polygonum plebejum* Br., and *Hyoscyamis niger* L. was studied. The daily alternating temperatures were found to favour germination and were partially successful in replacing light requirement for germination. Experiments with different lengths of the components of the daily alternating temperatures showed that certain durations of temperatures were more favourable than others. This thermoperiodic behaviour in seed germination was found to be related to the presence of an endogenous diurnal rhythm. This conclusion was based on the fact that when three hundred 4-hour durations of one component of temperature were applied to the various sets of seeds at different times spreading over 24 hours in regular sequence, the germination was not the same in different replicates but followed a course of germination corresponding to the thermoperiodic response experiments. The reaction to the same temperature thus changed at different times in the 24-hour cycle, corresponding with the two well-known phases of the endogenous diurnal rhythm. At various constant temperatures, the reaction to light was found to be different. In *Amaranthus fimbriatus*, for instance, the seeds were found to germinate only in dark at 20°, 23°, and 26° C., but at 33° C. the germination was independent of light or darkness. This phenomenon can be explained on the basis of the different temperature requirements of the two phases of the endogenous diurnal rhythm in seeds where germination is possible independently, owing to dark as well as light reactions.

Chaves Batista, A. University of Recife, Brazil. *The Soil as Reservoir for Candida infections in Children.* The incidence of candidiasis in babies is a problem still under discussion with regard to the source of the original inoculum. Infection of the genital apparatus of the mother has been proved to be the most prevalent cause of candidiasis in babies. In the rural areas of Recife, Brazil, where the population possess very inadequate notions of public hygiene the soil also functions as a reservoir for *Candida* spp. and as such is a potent source of inoculum of these fungi. Sanitary conditions are practically lacking in these areas and the human excreta are left on the soil surface, near or around the houses. The babies commonly pass the days outside of the houses creeping on the soil and so they get the *Candida* fungi as cutaneous candidiasis or intertrigo of gluteal folds and groin. On 16 infected babies, 3 to 11 months old, living in a rural area where mothers have been free of mycotic infections in their genital apparatus, the candidiasis of the babies was caused by the soil fungi, as confirmed by the isolation of *Candida albicans* from 19 soil samples taken from the area where the babies usually stayed.

Cheadle, Vernon I., and John M. Tucker. University of California. *Vessels and Phylogeny of Monocotyledoneae.* Evidence from over 500 species in 49 (of Hutchinson's) families that have vessels — some families lack vessels entirely — indicates that data on the absence or presence of vessels and on their relative specialization are valuable in analyzing putative phylogenetic affinities within the Monocotyledoneae. A wide range of variations in the levels of unidirectional specialization of vessels throughout the xylem in the several organs of the plant, and frequently even throughout the xylem in a given organ, provides opportunity for evaluating relationships among taxa. Such opportunity is enhanced by compelling evidence that vessels have originated independently within the Monocotyledoneae, but is narrowed by the fact that data on vessels can be used primarily in negating (although conclusively) some suggested phylogenetic affiliations. Use of the presently available evidence on the occurrence of vessels and their specialization leads to such conclusions as: (1) gramineae is beyond doubt highly specialized; (2) highly specialized vessels in roots of extant Butomaceae and Alismataceae throw serious doubt on their commonly assumed status as primitive families; (3) because Liliaceae contains many extant species of primitive nature, it could serve as an ancestral group for many other taxa; (4) Commelinales appear too specialized to serve as a possible ancestral source for many families.

CHEKMIN, I. F. *See* KONAREV, V. G., *et al.*

CHEN, CHI LING. Yale University. *Morphological Basis of the Systematics of Manilkara (Sapotaceae).* In 1943, Gilly proposed a modification of the conventional interpretation of the floral morphology of *Manilkara.* His view, which differs so greatly from that of the other authors, if accepted, would upset the basis of the present systems of the Sapotaceae. No anatomical evidence, however, has been presented that would support or refute his interpretation. According to the conventional view, the calyx is biseriate, and the third inner whorl of the flower is the corolla. Gilly considers that only the outermost whorl comprises the calyx, the second inner whorl being the corolla. The third whorl is regarded as staminodal. While the present study of vascular anatomy supports the conventional view in general, a revised interpretation is found to be necessary and is presented. The first series of vascular bundles departing from the pedicel, six in number, supply the outer two whorls. Half of the bundles vascularizes the outermost whorl, while the other half supplies the inner one. The vasculature of these two whorls is of the same pattern. The second set of vascular bundles comes from the intervening arcs of vascular tissue of the stele and supplies the remaining part of the flower, that is, stamens, staminodes, and the gynaeceum. From the present study it is considered justifiable to declare the following genera congeneric with *Manilkara: Achras, Northiopsis, Fancherea, Shaferodendron.* The combination of *Muriea* is also favored.

CHENNAVEERAIAH, M. S. Institut Botanique, Montreal. *Karyomorphological Studies in Aegilops L.* Among the cytologically known species of *Aegilops,* twelve are diploids with $2n = 14$ chromosomes. Eight species occur as tetraploids with $2n = 28$ chromosomes. Two species, *Ae. crassa* Boiss. and *Ae. triaristata* Willd., occur as both tetraploids and hexaploids. *Ae. juvenalis* (Thell.) Eig is known as a hexaploid only with $2n = 42$ chromosomes. With these chromosome constitutions, the genus is well suited for a biosystematic study. Karyomorphological studies have been performed on all these species as critically as possible. They show certain differences from those of Senjaninova-Korczagina (1932). Wherever karyotypic differences have been observed within each species and ploid-level, it has been possible to detect the morphological differences that exist in them but which are generally overlooked. The taxa that are known to be both tetraploids and hexaploids do have certain significant differences karyotypically as well as morphologically. Geographical distribution of these is also taken into account. These taxa, therefore, need to be separated and given the rank of distinct species which should be either a tetraploid or a hexaploid. Thus, the application of karyomorphological studies to the genus *Aegilops* reveals that both gradual speciation and abrupt speciation seem to be operative in this genus.

CHESSIN, M. Montana State University. *Some Effects of Ultraviolet Light on Plants.* There are many manifestations of ultraviolet injury to plants. Some can be prevented if ultraviolet treatment is not prolonged and is followed by exposure to visible light of wavelengths less than 4,500 Å. Photoreactivation of still other effects has not been studied. Recent attempts to identify the pigment responsible for absorbing reactivating light will be described.

CHICK, ERNEST W. Veterans Administration Hospital and Duke University School of Medicine. *North American Blastomycosis.* North American blastomycosis, caused by the fungus *Blastomyces dermatitidis,* is a disease of protean manifestations. Virtually any organ of the body may be involved although the lungs, skin, and bone are most frequent. Correspondingly, the clinical signs and symptoms may be quite varied. Epidemiological evidence indicates that infection occurs following contact with infected soil or soil products although *B. dermatitidis* has not been isolated from nature to date. There is a great need for improved methods for soil-fungus isolation. The diagnosis is verified by culture of the fungus, or by a combination of two or more of the following: demonstration of the fungus in exudates or fixed tissue, skin test, and serologic test. The appearance of growth of *B. dermatitidis* varies with the type of media, the temperature, and the time of incubation. The use of skin test and serologic tests for diagnosis is valuable, but there is a great problem with cross-reactions with other fungi and better antigenic preparations need to be developed. The use of potassium hydroxide preparations aids greatly in the demonstration of the organism in fresh material. The newer special stains for fungi in tissue sections greatly facilitate histopathologic study.

CHINOY, J. J., and K. K. NANDA. University of Delhi. *Auxin-catalized Biosynthesis of Ascorbic Acid by Dry-excised Embryos of Wheat.* We have shown elsewhere that ascorbic acid (AA) is synthesized in *Avena* coleoptile sections from sucrose. Attempts were, therefore, made to determine the effect of an exogenous application of 3-indoleacetic acid (IAA) (0.02 to 1.0 mg./l) in combination with sucrose (1.0 to 10.0 gm./l) on embryos of wheat dissected dry from mature seed, and kept at 10° C. (vernalization) as well as at 25° C. (control). Main results are: (1) growth is considerably accelerated in IAA plus sucrose solution; (2) negligible quantity of AA is synthesized in distilled water; (3) biosynthesis of AA is also very slow in IAA alone, but it proceeds rapidly in pure sucrose solution; (4) there is an early and a rapid rise in the concentration of AA in a medium containing both IAA and sucrose; (5) this increase due to IAA plus sucrose is especially well marked in sets incubated at 10° C. Early and more rapid biosynthesis of AA by wheat embryos from sucrose in the presence of IAA at a low temperature throws some light on the mechanism of vernalization and is significant in the light of recent work in this laboratory showing the importance of the interaction of IAA and AA in growth and flowering of some crop plants.

CHITALEY, S. Nagpur University, India. *Therapeutic Aspects of Palaeobotany.* In this paper some therapeutic values of certain palaeobotanical remains are discussed. The assessment is based on the author's empirical observations of medicinal use of plant fossils, and fossiliferous rocks from the Deccan Intertrappean Beds of India. References from *Indian Materia Medica* by Nadkarni, and from *Indigenous Drugs* by Chopra recording the use of fossil encrinite and clays such as Fuller's earth, led the author to start her investigation for exploring therapeutic uses of fossil flora. An experimental clinic assisted by medical practitioners has been launched by the author for recording the results of oral intake of sterilized, fine fossil powders called Fossilin. Over 400 cases have been recorded in the Clinic within a year. The observations in the Clinic show that Fossilin is definitely useful in tuberculosis, asthma, diarrhoea, dysentery, eczema, influenza, hypertension, menstrual disorders, and dyspepsia, amongst other diseases. Whether Fossilin acts chemotactically, biotactically, or neurotactically or by either stimulating or inhibiting the inherent enzyme activity of the protoplasm or by affecting the electroconductivity or the electromagnetic potentials of the protoplasm of cells of human body or otherwise has to be found out. It may be acting as a cell rehabilitator. For the present, the effect of Fossilin on plant cells is under experimental observation by the author. Further investigations will have to be carried out with different fossils preserved in different rocks and on correlation of the results obtained for ascertaining their therapeutic values.

CHOE, EUL SUK. *See* LEE, MIN JAI, *et al.*

CHORNEY, WILLIAM, and NORBERT J. SCULLY. Argonne National Laboratory, Illinois. *An Injection Technique for Efficient Infiltration of Compounds into Plants. In vivo* plant biochemical studies have been limited by the availability of efficient quantitative methods for introducing compounds into plants. Use of carbon-14 as a tracer indicates that the adsorption of many organic compounds by intact organ surfaces or through cut leaf tip surfaces is quite inefficient. In addition, failure to attain quantitative absorption by conventional application methods results partially from uncertainties in determining the amount of material adsorbed on the treated surface. Vacuum methods and infiltration through cut surfaces are limited to water-soluble materials. In most plant species, the rigidity of plant cell walls does not permit the use of a hypodermic syringe for injection of chemicals. A simple essentially quantitative method which may prove to be broadly applicable for introducing compounds into plants has been developed and evaluated. A drop of the desired solution is placed on the surface of an organ, after which this tissue area is punctured by a fine hypodermic needle inserted into the vascular region. Such treatment results in rapid uptake and distribution via the vascular system. The direction of the distribution is related to the particular organ employed. By this method it has been possible to infiltrate as much as 1.0 ml. of liquid into a plant in a few minutes. Radioautographs of the distribution of carbon-14 compounds in various plant species will be shown. Evaluation of the methods for use in biochemical and translocation studies will be discussed. (This work was performed under the auspices of the U.S. Atomic Energy Commission.)

CHOUARD, P. Sorbonne, Paris. *Introduction aux problèmes actuels de la vernalisation.* Les dix principales questions qui depuis dix ans se posent avec de plus en plus d'acuité sont les suivantes: (1) Y a-t-il des conséquences à tirer du fait qu'on sait maintenant que la vernalisation n'est pas associée à un type particulier de réaction photopériodique consécutive? (2) Modalités diverses de la vernalisation: A quel âge la plante est-elle vernalisable? Quelle est la quantité de froid nécessaire? Dans quelles limites de température, d'humidité d'oxygène et de glucide doit-on se tenir? Faut-il avoir recours à des températures constantes ou à des températures alternées? etc. . . . (3) La transmission de l'état vernalisé doit-elle être accomplie par un processus de type hormonal ou par le processus de perpétuation autocatalytique? (4) Comment les plantes ligneuses et polycarpiques entretiennent-elles l'état pérennant? (5) Quelles sont les conditions de fixation de l'état vernalisé et les possibilités de dévernalisation? (6) Comment la chaleur, le lavage prolongé, les jours courts, la gibbérelline ou autres agents chimiques peuvent avoir des effets anti-vernalisants? (7) Les extraits de graines, les jours longs, la gibbérelline, etc., peuvent-ils remplacer

le froid dans la vernalisation? (8) La vernalisation se déroule-t-elle en plusieurs étapes, indépendantes ou associées? (9) Quels sont les rapports existant entre l'action vernalisante du froid et l'action du froid sur les processus d'élongation par auxésis et par mérésis? (10) Quelles sont les transformations biochimiques et biophysiques qui se produisent pendant la vernalisation? Ces dix questions peuvent servir de base à une discussion sur les mécanismes de la vernalisation et sur l'établissement d'un programme coopératif de recherches nouvelles.

Chouard, P. Sorbonne, Paris. *The Place of Gibberellin and Auxin in Flower Induction.* L'auxine (A) et la gibbérelline (GA) ont pour fonction primaire de stimuler la croissance par grandissement cellulaire (auxésis). L'une et l'autre stimulent la prolifération cellulaire (mérésis), mais leurs effets sont différents. A inhibe les méristèmes primaires (apex) et stimule les méristèmes secondaires (cambium, cultures de tissus) tandis que GA fait souvent le contraire. A et GA agissent toutes les deux sur le développement reproductif mais de façons très différentes et selon des mécanismes encore très mal connus. Avant et après l'initiation des primordia floraux une légère augmentation de la production apicale d'A accroît en général le taux de floraison, quelles que soient les modalités photopériodiques de l'espèce considérée. Au moment de la formation des facteurs de floraison dans les feuilles ou de l'initiation des primordia floraux il y a souvent une diminution transitoire de la production apicale d'A et chez les plantes de jours courts A inhibe plus ou moins l'efficacité des facteurs de floraison naissant dans les feuilles. GA exerce des actions beaucoup plus puissantes mais déconcertantes. Elle provoque chez beaucoup de plantes en rosettes l'élongation et la mise à fleurs et remplace complètement l'action vernalisante du froid. Chez d'autres plantes en rosettes, cependant, GA provoque l'élongation sans la mise à fleurs. Chez les plantes caulescentes avant vernalisation ou en éclairement dyspériodique (non-inductif), quelles que soient les modalités photopériodiques de ces plantes, GA n'exerce jamais d'action stimulante sur la mise à fleurs et peut même provoquer un retour à l'état végétatif. Tout se passe comme si GA provoquait la mise à fleurs seulement chez les plantes inhibées par une insuffisante activité du méristème primaire. Les recherches effectuées avec GA ont permis de montrer que la floraison est un phénomène physiologique recouvrant, chez diverses espèces, plusieurs processus intimes foundamentalement différents.

Chouard, Pierre, et Andrée Lourtioux. Laboratoire de Physiologie végétale de la Sorbonne, Paris, et Laboratoire du Phytotron du C.N.R.S., Gif-sur-Yvette, France. *Problèmes physiologiques relatifs à une plante amphicarpique, le Scrofularia arguta.* Le *Scrofularia arguta* est une espèce annuelle originaire des fentes des rochers quartzeux du Maroc et de l'Afrique du Nord. Cette plante possède la particularité d'avoir deux modes de réaction au photopériodisme lors des inflorescences qui se produisent à son sommet et à sa base. Au sommet la plante forme une inflorescence en grappe rameuse dont l'initiation est fortement commandée par le photopériodisme: la floraison est très précoce en jours longs et très tardive en jours courts. Les rameaux principaux de cette inflorescence sont dressés obliquement et les rameaux secondaires sont tournés vers le bas. Les fleurs sont grandes et normales. A la base, aux aisselles les plus inférieures et tôt défeuillées, la plante forme des tiges entièrement démunies de feuilles et portant des inflorescences rameuses à géotropisme positif. Les fleurs

sont très petites et parfaitement fructifères. Si la floraison, à la base, est plus abondante en jours longs qu'en jours courts, l'initiation est cependant précoce en toutes circonstances et totalement indifférente au photopériodisme. La gibbérelline provoque, sur les rameaux aphylles à géotropisme positif, une extrême élongation et un renversement du géotropisme contrairement à ce qu'on aurait pu attendre des relations ordinairement supposées entre la gibbérelline et l'auxine. Cette plante soulève donc de nombreux problèmes physiologiques. Des expériences nouvelles sont en cours dont il sera rendu compte au Congrès.

CHOWDHURY, KAFIL AHMAD. Aligarh Muslim University, India. *Limitations of Anatomical Aid to Taxonomy of Angiosperms.* When work on taxonomy was started, "Special creation" was the accepted doctrine. The philosophical thoughts contained in Darwin's *Origin of Species* and Mendel's "Law of Inheritance" were generally accepted by taxonomists and some of them even talked of "natural classification," but actually they made only small changes in their method of working. However, newer disciplines such as anatomy, embryology, genetics, cytology, and palynology have made considerable progress in their respective fields. In the course of their study of variation, they have occasionally questioned the validity of taxonomic classification at different ranks. As a result of all these, there is now a confusion in the mind of many workers as to the exact position taxonomy holds amongst the various disciplines of botany. To avoid further confusion, it is suggested that orthodox taxonomy and phylogenetic taxonomy may be treated as separate disciplines. This is necessary because the achievements of orthodox taxonomy have been tremendous and it should not be disturbed in its path of progress. As regards phylogenetic taxonomy, it will take many many years to obtain a clear picture of the variation displayed by different organs of the same plant and then finally determine their co-relation, taking the entire plant as a unit of organic evolution. Now, anatomy can render some aid to both these disciplines, but the extent of help will be rather limited.

CHOWDHURY, KAFIL AHMAD. Aligarh Muslim University, Aligarh, India. *Recently Reported Fossil Woods from India and Their Significance.* Some nine years ago, I reported on the dictotyledonous fossil woods of India. Since then a fairly large number of them has come to the notice of palaeobotanists. Four new families have been discovered. They are *Combretaceae, Ebenaceae, Lythraceae,* and *Sapindaceae.* During this period new localities for some of those already reported have also been found. In the case of *Anisoptera* it now appears that the genus has migrated more than 1,200 miles towards the southeast during the last 30 million years. However, the most important information has been revealed by one of the fossil woods from the Miocence formation of Burma. This wood shows all the variations that are found in the living species *Terminalia tomentosa,* W. & A. It may be recalled that it was in the diffuse porous wood of living *Terminalia tomentosa* that initial parenchyma cells were found for the first time. The genus seems to have diffuse porous structure sometimes and sometimes semi-ring porous structure; this variation is inherent and not due to different environmental conditions.

CHRISTENSEN, J. J. University of Minnesota. *Somatic Variation in the Rust Fungi.* Anastomosis of germ tubes arising from urediospores and aeciospores and hyphal fusion in the host are common among many species of rust. By this means nuclei from widely different sources may be brought together to form new genetic combinations, somatic "hybrids." Certain mixtures give rise to many new biotypes, others do not. The use of biotypes with contrasting characters facilitates analysis. Nuclear reassortment, parasexualism, exchange of chromosomes, cytoplasmic influences, and mutation may be the cause of the diversity of biotypes and races arising from mixtures of the parental types. Nuclear reassortment does not account for all the observed variations because eleven new entities, some never previously described, have been identified from a mixture of urediospores of two races of stem rust. This suggests that processes similar to parasexualism may be involved. If the nuclei do not fuse, perhaps there is exchange of chromosome material. New biotypes having two or more nuclei per cell are unstable, but when nuclear dissociation occurs, the dicaryotic biotypes formed are stable. It is also possible that the effect of cytoplasm and mutation may play an important role. Biotypes arising from urediospore mixtures between two varieties of *Puccinia graminis* are somewhat similar in pathogenicity to those produced by sexual hybridization on the barberry.

CHURCH, GEORGE L. Brown University. *Introgressive Hybridization in Minnesota Species of Elymus.* A study of the grass genus *Elymus* in central Minnesota reveals the occurrence of intergrading populations of *E. canadensis* L., *E. diversiglumis* Scribn. & Ball, and *E. wiegandii* Fern. Forms intermediate between *E. canadensis* and *E. diversiglumis* are frequent along woodland roads. They are vigorous and fertile in spite of the appearance of occasional meiotic irregularities and 10 to 20 per cent lowered chiasma frequencies. Comparable forms have been produced artificially by backcrossing sterile F_1 hybrids to *E. canadensis*. Artificial crosses of *E. diversiglumis* and sympatric *Hystrix patula* Moench resulted in a few weak F_1 seedlings. In contrast, the attempted crossing of *Hystrix* and *E. canadensis* was repeatedly a failure. It is suggested that *E. diversiglumis* may have arisen through the cross of *Hystrix* and *E. canadensis* at a remote period and is now isolated by genetic barriers from *Hystrix* but not from *E. canadensis* as is manifested by the present intermediate forms. *E. wiegandii* is reported for the first time in this area at stations of very recently disturbed habitats. It is also a component of the "canadensis-complex." All collections show varying amounts of meiotic irregularities due to neocentric chromosomes or structural hybridity. They intergrade both with *E. canadensis* and with forms of *E. diversiglumis*. The only artificial cross yet made is with *E. canadensis*, but it has resulted in vigorous F_1 seedlings.

CIFERRI, O., E. R. BLAKELEY, and F. J. SIMPSON. National Research Council of Canada, Prairie Regional Laboratory. *The Metabolism of 2-keto-D-gluconate by Leuconostoc mesenteroides.* Cells of *Leuconostoc mesenteroides* grown on 2-keto-gluconate contain a specific and adaptive 2-keto gluconokinase that, in the presence of ATP and $MgCl_2$, transforms 2-keto-gluconate into 2-keto-6-phosphogluconate. The same cells, in addition to a DPN-linked 6-phosphogluconate-dehydrogenase, possess an enzyme that in the presence of 2-keto-6-phosphogluconate oxidizes DPNH. The activity of the latter enzyme is stimulated by inorganic phosphate, while the former is inhibited. Crude or partially purified preparations from cells grown on 2-keto-gluconate catalyze the breakdown of 2-keto-6-phosphogluconate and 6-phosphogluconate with production of carbon dioxide; however, CO_2 production is greater and more rapid in the presence of 2-keto-6-phosphogluconate than of 6-phosphogluconate. (The reverse is true for cells grown on gluconate.) In addition, the production of pentuloses (of which ribulose-5-phosphate has been identified) and of acetyl-phosphate is greater when 2-keto-6-phosphogluconate is the substrate than when 6-phosphogluconate is used. Such results are believed to indicate the presence of an alternate pathway for the degradation of 2-keto-6-phosphogluconate that does not involve 6-phosphogluconate.

CIFERRI, RAFFAELE. The University, Pavia, Italy. *A Taxonomical Prospect of Fungi.* A graphical prospect of taxonomy of fungi is presented. The recent views on fungi classification are considered and, up to a certain point, harmonized. The phylogenetic relationship and certain characteristics are emphasized.

CLARK, FRANCIS E. Agricultural Research Service, Fort Collins, Colorado. *Influence of the Microbial Population of the Rhizosphere on Plant Development.* The non-pathogenic micro-organisms intimately and profusely associated with plant roots influence plant welfare in numerous ways. They elaborate or variously transform complex organic materials. They move inorganic nutrients into forms of greater or less availability. They influence the micro-climate in the immediate root zone. Much is now known concerning the elaboration of vitamins, antibiotics, and other organic substances within the rhizosphere, but knowledge of the extent of activity of such materials produced by microbes *in situ* lags well behind that which is known about the activities of root parasites. The delicacy of a physiological balance between root-associated bacteria and chlorophyll development in the soybean plant is presented in some detail. Production of the causal factor is varietally dependent with respect both to the bacterium and to the soybean plant. It is probable that at least some differing varietal responses in crop plants are directly linked to their rhizosphere microfloras. The antagonistic or sanitary potential of the saprophytes within the rhizosphere lately has received more emphasis than has their ability to accomplish either desirable or undesirable nutrient transformations. Nevertheless, such changes are continually being effected and at times they have drastic influence on plant growth and welfare. Some relations between rhizosphere microfloras and soil nitrogen transformations are discussed.

CLARK, J. Canada Department of Agriculture. *Birch Dieback.* Birch dieback was first observed in central New Brunswick about 1932 and has since become widespread in the greater part of Eastern Canada. Large quantities of yellow and white birch have died. The cause remains obscure. Various studies indicate that associated fungi and insects are secondary. Virus-like symptoms have been described, but their relation to dieback has not yet been determined. Failure to demonstrate any clear biotic cause led to serious consideration of the hypothesis that dieback was a physiological disturbance resulting from climatic factors, but evidence presented in support of this viewpoint has not been conclusive. Growth-ring analyses of surviving trees show a relationship between radial growth and the June-August water balance both before the onset and during the course of dieback, but the climatic data fail to explain the drastic growth reduction during the early years of the disease. The dates of first recognition of early symptoms and of the characteristic decline in radial growth indicate an apparent spread of the disease from central New Brunswick. This, and other evidence, suggests that a pathogen, such as a virus, may be the primary cause.

Clarke, I. D. Wantage Radiation Laboratory, England. *Some Effects of Gamma Radiation on the Chemical and Physiological Changes in Fruits.* The changes in texture of certain irradiated fruits stored for various periods of time at 20° C. and at lower temperatures have been investigated. A decrease in firmness has been observed in all plant materials treated with dose levels of 1×10^5 rads and above but this effect may no longer be apparent after a period of storage, and in certain cases the irradiated fruit may be firmer than the untreated fruit. Changes, correlated with dose levels, have been shown to occur in heterogeneous, water-soluble carbohydrate fractions, which were extracted from the alcohol insoluble residues. Studies on the viscosity of juice extracted from irradiated fruit provided further evidence that one of the major effects of this treatment is the degradation of pectic substances. The effect of radiation on the titratable acidity and soluble and insoluble nitrogen fractions has been determined for several fruits. The rate of internal breakdown during storage at low temperatures was determined for two varieties of apples (Cox's Orange Pippin and Tydeman's Late Orange) and two varieties of pears (Conference and Doyenne du Commice), which had received doses of 1×10^5 and 2×10^5 rads.

Claus, George. Academy of Natural Sciences, Philadelphia. *Concerning the Algal Flora of the Peace Cave at Aggtelek in Hungary.* The existence of assimilating chlorophyllous plants in the complete darkness of the inner parts of larger caves was unimaginable for a long time. The investigation of several caves in Hungary, however, proved that a fairly large number of algae representing all of the known divisions except Phaeophyta can be found in the mentioned places. The present paper deals with the algal flora of the "Peace Cave" located in the northern part of Hungary. Of special interest in this case is that the collections were made just a few months after an artificial inlet was bored into the entombed cavity system. The fact that the cave system was completely closed precludes the possibility of previous contamination caused by air, animals, or man; or that even minimal amounts of light could penetrate in it. The investigations carried out resulted in the collection of 28 algal taxa, of which the most numerous belonged to the Cyanophyta division, but Chlorophyta and Euglenophyta were also present. Two of the blue-green algae are new to science and many others should be considered as preglacial relics. In comparing these results with those obtained from other investigated caves, our hypothesis about the fact that the algae entered them parallel with their development seems to be strengthened because the nearby "Baradla Cave" shows an entirely different algal population. We have only assumptions about the possible energy sources which enable these algae to carry out normal vegetative life—they did not, or only partially, occur in a resting stage.

Clauss, H., C. D. Nelson, D. C. Mortimer, and Paul R. Gorham. National Research Council, Ottawa. *Factors Affecting Translocation of Photosynthetically Assimilated C^{14}.* Downward translocation of C^{14} from primary leaves of soybean was studied during steady-state photosynthesis. Leaves were allowed to carry on photosynthesis for 30 min. in 0.03, 0.15, or 0.3 per cent $C^{12}O_2$ followed by 10 min. in $C^{14}O_2$ at the same total CO_2 concentrations. There was little effect of carbon dioxide concentration on the products isolated from the treated leaf. There were no direct effects of carbon dioxide concentration on translocation; the C^{14} content of the stem decreased logarithmically from the primary leaf. In plants grown in vermiculite, at least 95 per cent of the C^{14} in the stem was recovered as sucrose. In plants grown in solution culture, C^{14} compounds in addition to sucrose were isolated from the stem. As the plants became older, less C^{14} was translocated out of the primary leaf. Under some conditions octanol vapor surrounding the treated leaf inhibited translocation of C^{14} in the stem.

CLEMENTS, HARRY F. University of Hawaii. *Crop Logging of Sugar Cane in Hawaii.* As soon as a sugar-cane crop is old enough to provide leaf blades and sheaths, nos. 3, 4, 5, and 6 (counting down from the most recently emerged leaf tip as no. 1) sampling of the field begins and continues thereafter at 35-day intervals until harvest. The specified sheaths and blades when removed from each of five stalks of cane constitute one sample. They are weighed, chopped, and dried. Sheath samples are regularly analyzed for tissue moisture, potassium, and total sugars. The leaf blade is analyzed for total nitrogen. When the crop is in its maximum growth period, three consecutive sheath samples are also analyzed for calcium, magnesium, phosphorus, and the minor elements. A recently matured internode is also analyzed for phosphorus. Ripening of the crop is followed, using the sheath moisture as a guide. Bases of reporting these data, their use in crop guidance, and their value in research will be the subject of the presentation.

CLISBY, KATHRYN H., and FRED FOREMAN, Oberlin College, Ohio; and PAUL B. SEARS, Yale University. *A Pollen and Sediment Record of the Pliocene-Pleistocene in New Mexico.* Playa Lake, San Augustin, New Mexico, has yielded a pollen and sediment profile which extends through the Pleistocene and well into the Pliocene. Sedimentation begins in the 1,600-foot core with evidence of marked volcanic and tectonic activity to a depth of 850 feet. Quiescent horizons show pollen dominated by *Pinus*, but include *Pterocarya* and other broad-leaved temperate genera. Two radiocarbon dates in the upper 30 feet give a rate of deposition of about 1,000 years per foot, very similar sediments continue to a depth of 850 feet, and a corresponding rate of deposition may be extrapolated to this depth. The flora as reflected by pollen consists of: sage steppe (850-525 feet), mixed scrub and pine woodland (525-255 feet), montane forest (255-0 feet). The effect of regional uplift as well as major continental climatic changes on vegetation is reflected in the profile.

CLOWES, F. A. L. Oxford University. *The Root Apical Meristem and Its Cellular Organization.* It is useful to regard angiosperm root meristems as having a promeristem consisting of several initial cells. It may never consist of a single cell even in the embryo. It is not clearly delimited, and it fluctuates in size and in the number of its cells. In embryos and lateral primordia it is small and consists of few cells at first. In some roots it remains so, but in most it expands. In expanding, some of its original cells become quiescent and their function as initials is taken over by adjacent cells. In most mature roots it consists of many cells lying over the surface of a central mass of quiescent cells.

These quiescent cells can be detected by their low rates of DNA and protein synthesis and by their low DNA, RNA, and protein contents. They divide rarely or never and are carried forward by the activity of the surrounding meristem. They form a reservoir of cells which, when the meristem behaves abnormally, may increase their rates of syntheses and become meristematic again. The boundary between the quiescent centre and the meristematic cells fluctuates on the proximal side during normal growth, but apparently not on the distal side.

Clutter, Mary E., and Ian M. Sussex. University of Pittsburgh. *The Induction of Meiosis in Sporangia on Excised Fertile Pinnae of Osmunda cinnamomea in vitro.* Previous work has shown that sporangia develop on excised fronds of some osmundaceous ferns grown *in vitro* on high sucrose concentrations. Subsequent cytological studies have shown that these sporangia did not yield viable spores. In fact, the sporangia did not go through meiosis. The present investigation was concerned with the induction of meiosis in fern sporangia growing in sterile culture. Under natural conditions sporangia are initiated late in summer and do not undergo meiosis until the following spring as the fertile fronds emerge from the bud. In these experiments pinnae were removed from fertile fronds of the winter bud throughout the fall and winter and prior to meiosis in the spring. The pinnae were cultured on media of varying sucrose levels and on media containing various growth-regulatory substances. Results showed that the sporangia on cultured fertile pinnae completed meiosis and yielded spores of approximately normal morphology. Prothalli which developed subsequently from these cultures gave rise to normal appearing sporelings.

Cohen, Arthur L. Oglethorpe University, Atlanta, Georgia. *An Electron Microscope Study of Flagellation in Myxomycete Swarm Cells.* Work now in progress indicates that the swarm cells of some Myxomycetes are biflagellate, while others are monoflagellate. Also fine pseudopodial processes are formed which may be mistaken for flagella in stained preparations. There is evidence that these pseudopodia may form at the tips of the flagella as well as on the cell body.

Cole, J. S. Tobacco Research Board of Rhodesia and Nyasaland. *Field Spray Trials against Wildfire and Angular Leaf Spot of Tobacco in Rhodesia.* Seedbed and field tests of streptomycin, oxytetracycline, neamycin, aureomycin, and copper for the control of *Pseudomonas tabaci* and *Pseudomonas angulata* were made in Southern Rhodesia. Streptomycin, which was absorbed through the leaves, was the most effective in three trials. In another, laboratory tests showed that pathogenic strains of *P. tabaci* developed, half-way through the trial, which were considerably less sensitive to streptomycin than the original culture. This was followed by a substantial reduction in disease control in all the streptomycin treatments. Oxytetracycline was the only one of the other antibiotics which showed any promise. Copper was reasonably effective in all trials. When streptomycin-sensitive and resistant cultures were used, a mixture of half-strength streptomycin and copper was slightly better than full-strength copper. Against streptomycin-resistant strains, quarter-strength streptomycin and oxytetracycline and half-strength copper, combined, was slightly better than half-strength oxytetracycline and copper, or full-strength copper.

Colvin, J. R. National Research Council of Canada. *Extraprotoplasmic Synthesis of Cellulose by Acetobacter xylinum and Higher Plants.* Previous observations have shown that bacterial-cellulose microfibrils formed by *A. xylinum* grow from the tip only outside the cell and remote from its surface. No extensive amorphous polymeric intermediate is involved. As an extension of this work, the preparation of an ultrafiltered ethanol extract of active cultures of *A. xylinum* will be described from which microfibrils may be produced which are resistant to sodium hydroxide hydrolysis, which have the typical morphology of bacterial cellulose, and yield only glucose as a component neutral sugar after sealed-tube acid hydrolysis. Formation of these microfibrils is inhibited by autoclaving of the extracts and restored by addition of the ultrafiltered medium of an active culture. Results of the fractionation and chromatographic identification of components of the extract will be summarized. These results and other recent independent evidence from investigations on higher plants suggest that present ideas on the mechanism of cellulose synthesis in plants need revision.

Common, A. *See* Kapica, Lucia, *et al.*

Commoner, Barry. *See* Lippincott, James A., *et al.*

Conn, Eric E., and Colette Bove. University of California. *Metabolism of a Cyanogenic Glycoside.* Sorghum contains the cyanogenic glycoside, dhurrin, the glucoside of the cyanohydrin of p-hydroxybenzaldehyde. Etiolated sorghum seedlings have been utilized in studies on the metabolism of dhurrin. As regards biosynthesis, experiments with carbon-14 labeled compounds have demonstrated that the amino acid tyrosine is a highly effective precursor of the cyanohydrin component of the glucoside. These results suggest that free HCN and p-hydroxybenzaldehyde are not intermediates in the biosynthesis of dhurrin. As regards the hydrolysis of dhurrin, the sorghum plant contains enzymes which hydrolyze the glucoside to HCN, p-hydroxybenzaldehyde and glucose. The initial step in this process is catalyzed by a glucosidase which hydrolyzes the glucoside to glucose and p-hydroxybenzaldehyde cyanohydrin. The sorghum plant contains a second enzyme, oxynitrilase, which catalyzes the decomposition of the cyanohydrin to HCN and p-hydroxybenzaldehyde. This latter enzyme has been purified 150 times from three-day-old etiolated sorghum seedling plants and partially characterized. Some of the properties of the enzyme will be described.

Conn, Eric E. *See* Kosuge, T.

Constance, Lincoln. *See* Mathias, Mildred, *et al.*

Converse, Richard H. U.S. Department of Agriculture. *In vitro Test of Host-Parasite Relations of Pecan Scab.* Four races of *Fusicladium effusum* Wint., the incitant of scab of pecan (*Carye illinoensis* (wang.) K. Koch), have recently been recognized in Oklahoma; each one is most pathogenic on a certain variety (cultivar) and evokes hypersensitive responses on certain other varieties. Newly emerged leaflet discs of five pecan varieties were placed on water agar seeded with conidia from lesions on the four principal hosts of these four races. The mean lengths of germ tubes growing near discs under standard conditions agreed well with the pathogenicity of the races on the same hosts determined by ordinary techniques *in vivo*. Germ-tube lengths near leaflet discs of susceptible varieties exceeded those near resistant varieties in 16 of 19 different conidia-disc combinations. Diffusion of inhibitory substances from the leaflets is indicated, but purification of substances that may be involved in the differential depression of growth of germ tubes *in vitro* has not been attempted, except to note that they are heat-labile.

COOK, JAMES A., and A. C. GOHEEN. University of California, and U.S. Department of Agriculture. *The Effect of Leafroll Virus and Potassium Deficiency on the Mineral Composition of Grape Leaves.* Leafroll and potassium deficiency occur in both European and California vineyards. In California, leafroll is far more widespread than potassium deficiency. Visual symptoms of both are similar and undoubtedly this similarity in many cases has led to errors in diagnosis. Detailed, comparative studies were made in the vineyard and in sand cultures. Both disorders have a dwarfing effect, but neither shows early-season leaf symptoms or differences in tissue analysis. Symptoms of potassium deficiency may develop prior to bloomtime while those of leafroll appear about mid-summer. Potassium deficiency shows first as a gradual chlorosis beginning at the edges of mid-shoot leaves. Leafroll symptoms begin with a downward rolling of basal leaves. In the fall both disorders show chlorosis, rolling, and burning of leaves, and both affect fruit quality. After symptoms appear, analyses of leaf blades indicate low potassium in both disorders. With adequate potassium, petioles from leafroll vines showing symptoms are high in potassium, while petioles from potassium-deficient vines are low. Where potassium deficiency exists, leafroll accentuates the deficiency symptoms.

COOKE, WM. BRIDGE. Robert A. Taft Sanitary Engineering Center, Cincinnati. *The Genus Schizophyllum.* Five species of *Schizophyllum* have been recognized in a study of nearly 3,000 specimens loaned by 38 major herbaria. Specimens have been seen from 98 political areas in the world. Only three states in the United States and three Canadian provinces have not reported the occurrence of a species in this genus. *Schizophyllum commune* has been found on 322 species of named hosts and on 20 miscellaneous habitats such as human toe nails and a wooden diving board. More than 95 per cent of the collections seen are of *S. commune*. Two species make up most of the remaining records. Both *S. fasciatum*, with abundant cystidia, and the small golden brown *S. umbrinum* occur throughout the Caribbean and Gulf of Mexico area. *S. leprieuri*, with colored spores, is represented by three collections from along the northern coast of South America, and S. n. sp., with large spores, has been found only once—in the State of Goias, Brazil. Only *S. fasciatum* and *S. leprieuri* have not yet been obtained in pure culture. Because of the extreme variability of *S. commune*, and its wide geographic and host range, it has received a fairly large number of names. Studies by Dr. John Raper and his associates indicate that only one species is involved.

COOKE, WM. BRIDGE. U.S. Public Health Service. *The Natural Occurrence of Aureobasidium.* A comparative study of 160 cultures of fungi assigned by various workers to the species *Aureobasidium* (*Pullularia*) *pullulans* has been carried out. This includes a number of cultures obtained from human and environmental sources which are more correctly assigned to *Pullularia werneckii* (Horta) de Vries. Isolates from the environment include strains from soil in California, from air in Ohio, and from a mattress stored in Mississippi. The genus *Pullularia* is antedated by *Aureobasidium.* In culture, this genus is characterized by the presence of slimy radula spores produced on minute apiculate projections from any cell of the mycelium. Under certain cultural conditions, spores may be produced by repetition or by budding as is true in the case of many Fungi Imperfecti and Ascomycetes. Members of the genus have become known as black yeasts because of this habit. The *P. werneckii* may be more restricted in nature than *A. pullulans* but this restriction is probably more apparent than real. It is a slow-growing fungus which appears similar in culture to other dematiaceous fungi so that it may readily be overlooked. This results in its being better known as a skin disease, causing disorders such as *Tinea nigra palmaris* in tropical countries.

Cooper, D. C. University of Wisconsin. *The Embryo and Endosperm in Hybrids.* Seed abortion often follows interspecific cross-pollination. Double fertilization occurs stimulating development of both endosperm and embryo. The endosperm develops slowly and fails to play a dominant role during the course of early ontogeny of the seed. Adjacent meristematic maternal tissues, utilizing much of the nutrient materials normally destined for the endosperm and embryo, become hyperactive and form an excess anomalous tissue within the young seed. The endosperm, unsuccessful in competition with this hyperplastic tissue, ceases further growth. The embryo continues to develop until the endosperm is utilized and then dies of starvation. In some instances the endosperm develops more or less normally during the early stages of ontogeny. Later an absorbing region fails to become differentiated and, as a result, the endosperm ceases further expansion. The embryo continues to develop at the expense of the extant endosperm until most of it is utilized and then ceases further growth. The more advanced embryos may reach such a stage of differentiation that they will continue to grow and develop when excised and transferred to a culture medium. Desired hybrids can often be procured by utilizing this technique.

Cormack, M. W. *See* Lebeau, J. B.

Cormack, Robert G. H. University of Alberta. *The Development of Root Hairs.* Root hairs are considered to be evaginations produced by internal pressure on weaker portions of an unequally hardened cell wall. Consequently, investigations on the initiation and development of root hairs have centered on the structure, chemical composition, and growth of the epidermal cell walls. Two opposing views have been formulated. One, supported strongly by the present writer, maintains that the root-hair wall consists of an inner layer of cellulose and an outer layer of calcium pectate continuous with corresponding layers in the hair-forming cell. According to this view hardening is associated with the reaction between calcium ions in the external medium and pectic acid in the outer wall layer. The second view holds that the root-hair wall is composed of a framework of cellulose microfibrils enmeshed in a cementing matrix of pectic material. Hardening is considered to be due to the laying down of new cellulose strands. This present paper outlines briefly the role of calcium in root-hair formation and discusses the structure of the epidermal cell wall in the light of evidence obtained by use of the electron microscope.

CORNS, WILLIAM G. University of Alberta. *Growth Responses of Some Grasses and Cereals to Plant Regulations.* The paper deals with certain aspects of the use of growth regulators as selective herbicides or for potentially beneficial direct influence on forage plants.

CORTESI, R. *See* STROUN, M.

COUEY, H. MELVIN. *See* SMITH, FREDERICK G., *et al.*

COUPLAND, R. T., and J. S. MAINI. University of Saskatchewan. *Woodland Invasion of Western Canadian Grasslands.* Aspen (*Populus tremuloides* Michx.) forms a mosaic with grassland throughout the black soil zone to form the aspen grove region in the prairie provinces. Reports of pioneers have indicated that this invasion of previously open grassland has taken place due to protection from fire during the 75 years since the beginning of settlement. Recent studies have shown that groves existed throughout the region previously but were inconspicuous because of frequent burning of the grassland. The effect of settlement has been to permit the trees to reach considerable stature (up to 35 ft. in height and 9 in. D.B.H.) and for individual groves to expand vegetatively, while new groves have frequently become established in the vicinity of older ones; the extent of recent invasion of the grassland zone by forest in this region is considered to be insignificant compared to the increase in the region already occupied by dwarf aspen at the time of settlement. This eliminates one line of evidence used by geographers to support the opinion that the vegetation of the Great Plains is potentially forest.

COUPLAND, ROBERT T. *See* BAKSHI, TRILOCHAN S.

COX, D. K. Research Division, Syntex, S. A., Mexico. *Factors Affecting the Distribution and Abundance of Sapogenin Containing Dioscorea spp. in Mexico.* Of the 67 *Dioscorea* spp. occurring in Mexico, seven are of interest because of their use, actual or potential, as a raw material for the synthetic hormone industry. Of the seven species *D. composita, D. floribunda,* and *D. spiculiflora* have been the object of several years' investigation due to their wide distribution, high sapogenin content, and abundance. The principal factor affecting their distribution is climate, being characterized by a six-month summer rainy season and very dry winters. Abundance of the species may be attributed to vegetation changes and land use practices, both due to human activity. Vegetative reproduction from tuber pieces broken up during plowing of cultivated land accounts for increased abundance on recently cultivated and abandoned fields. In fields under constant cultivation of crops such as sugar cane, the *Dioscorea* spp. disappear in from three to five years. Fire, used for clearing land, is responsible for the aspect dominance of the *Dioscorea* spp. which are not damaged by the heat owing to their fleshy hypogeous tubers. The temporary dominance disappears with the invasion of vines and shrubs.

CRAFTS, A. S. University of California. *Comparative Mobility of Tracers in Plants.* Carbon-14 labeling of organic compounds has provided many tracers that are proving valuable for translocation studies. Some such compounds are herbicides, others growth regulators, dormancy inducers, flower setting agents, and other physiologically active materials. If labeled at a specific activity of 0.5 mc. per mM or higher, they are useful in the autoradiographic technic. Freeze drying, mounting, and pressing methods developed at Davis, California, are proving very valuable in studies of solute movement. And compounds labeled at the above specific activity or higher may be used at subtoxic dosages to provide information on solute uptake and distribution in intact plants. Early studies have shown that labeled 2,4-D* is absorbed by leaves and transported in the phloem along with assimilates. When assimilates are moving rapidly, 2,4-D* may attain a wide distribution in the plant; if assimilate movement is slow, distribution is limited. More recent studies show that, applied to barley plants, the following mobility series may be demonstrated: 2,4-D< IAA< ATA< MH< dalapon. In potato tuber tissue, the first four show the same relation. As one follows through this series, he sees that the mature foliage of the treated plants is most heavily labeled by the most mobile compounds. Since this mature foliage is itself exporting assimilates, it seems that its labeling must result from leakage of the tracers from phloem to xylem and their upward transport in the transpiration stream. Mobility and such leakage are positively correlated.

CRAMPTON, B. *See* STEBBINS, G. L.

CRANE, FERN W. Summit, New Jersey. *Key to American Dryopteris Species Based on Perispore Characters.* North American species of true *Dryopteris* are difficult to determine accurately, for the morphology varies from plant to plant within a single rank. However, it is demonstrated that the sculpturing and the detailed markings on the perispore, or spore covering, are constant for each one of the species considered. The appearance of aborted and abormal spores is a clue to hybridity although the frond itself may not exhibit an obvious hybrid aspect. A simple, artificial key based on the characters of the perispore illustrates the principle of spore analysis. A new species of *Dryopteris*, included in the key, is described. Its type specimen is deposited in the U.S. National Herbarium.

CRITCHFIELD, W. B. Harvard University. *Leaf Dimorphism in Populus trichocarpa.* In this species, as in many other poplars, each tree bears two kinds of leaves, referred to here as early and late. They differ in many features of external morphology, including petiolar length, occurrence and size of marginal glands, thickness, coarseness of the visible venation network, and stomatal distribution. This type of dimorphism has its origins in a fundamental difference in leaf ontogeny. The early leaves overwinter in the bud as well-developed embryonic leaves whose major features are already delineated. The first late leaves are also present in the winter bud, but as arrested primordia; succeeding late leaves develop uninterruptedly from initiation to maturation during the growing season. The expansion of the pre-formed early leaves is almost completed by late spring when the first late leaves begin to grow rapidly. The formation of late leaves may then continue until late in the season. Little stem elongation occurs during early-leaf development. Not until the first late leaves expand does rapid elongation commence, and then it is restricted to shoots producing late leaves. Consequently, the early leaves are confined to short shoots and the base of long shoots; first-year sprouts and the upper part of long shoots bear only late leaves.

CRONIN, M. *See* REISS, F.

CROSS, AUREAL T. Pan American Petroleum Corp. Research Center, Oklahoma. *Plant Microfossils of Latest Paleozoic Age in the Northern Appalachian Basin.* More than 60 species of microspores and 25 species of megaspores are now recognized from rocks of upper Allegheny, Conemaugh, Monongahela (Pennsylvanian), and Dunkard (lower Permian?) age in West Virginia, eastern Ohio, and western Pennsylvania. The number of species represented declines steadily from about 50 in 25 genera in the Allegheny strata to about 30 in 15 genera in the upper Dunkard. More than half of these are of uncommon or rare occurrence. Spores of the genus *Laevigato-sporites* are dominant throughout this stratigraphic sequence both in total number of species and in spore population. A number of plants of earlier range gradually disappear in this interval, *Densosporites* and *Lycospora* in the Allegheny and *Reticulati-sporites* and *Cirratriradites* in the Conemaugh. Most species of the *Triletes* complex are absent by Monongahela time. Less than a dozen species have been found to first appear in Monongahela or Dunkard, including two new conifer-type pollen and two others assigned to two new genera. Typical Permian floras are not recognized. The principal taxonomic groups, stratigraphic assemblages, and ranges are indicated and illustrated.

CROSS, AUREAL T. *See* GILLESPIE, WM. H.

CUMMING, BRUCE G. Canada Department of Agriculture. *Light and Temperature Sensitivity in Germination and Very Early Floral Initiation of Some Chenopodium Species.* Differences in sensitivity to light and temperature suggest reasons for the distribution and weediness of the following four species, arranged in order of increasing weediness in Canada. (*a*) *C. rubrum* L. At 35° C. red and white light stimulates, while infrared and blue light inhibit germination. Red/infrared reversal effects occur after 1-minute light flashes. Germination is negligible at temperatures below 25° C. Macroscopic ovule formation can be induced under 8-hour day lengths as early as eight days from the start of seed imbibition with water; minimum true leaf number is two. (*b*) *C. glaucum* L. var. *salinum* (Standley) Boivin, and (*c*) *C. glaucum* L. var. *glaucum* Aellen, show lower light and temperature sensitivity in germination. Under 8-hour day lengths floral initiation is relatively slower with minimum leaf numbers of two and four respectively. (*d*) *C. album* L. Photoblastism is least pronounced. This species is the least rapid to flower under 8-hour day lengths and minimum leaf number is greater. Long day lengths retard floral initiation most in species (*a*) and (*b*), less in (*c*), least in (*d*). Species (*a*), (*b*), and (*c*) provide valuable test material for studies on morphogenesis. Large plants can be obtained under LD, while, under SD, plants can be grown to maturity on filter paper in petri dishes.

CURL, HERBERT C., Jr. Woods Hole Oceanographic Institution, Massachusetts. *The Physiological Ecology of a Marine Diatom, Skeletonema costatum (Grev.) Cleve.* The marine plankton diatom, *Skeletonema costatum* (Grev.) Cl. was isolated and cultured. The effects of light, temperature, salinity, absolute concentrations of phosphorus and nitrogen and the ratio of these elements on the growth and photosynthesis of the diatom were measured. The factors were varied separately and simultaneously. The results are used to explain the temporal and spatial distribution of *Skeletonema* in continental shelf waters off New York. The diatom was found to be a primary species during late summer and early winter by virtue of its responses to light and temperature alone. Offshore salinities and high P/N ratios were deleterious to photosynthesis. The absolute concentrations of P and N normally found on the continental shelf were not found to be limiting. Zooplankton grazing appeared to be an important factor in late summer. On the basis of the factors examined, *Skeletonema* should fare much better offshore than it does. Some factor, presently being searched for, limits it to inshore areas. At the seasonal maximum in December, *Skeletonema* accounted for 43 per cent of the total daily photosynthesis in inshore waters.

CURRIER, H. B. University of California. *Callose Formation in Plant Cells.* Callose forms in pits of parenchymatous walls following wounding or other injury. The primary phase of this pit callose reaction can be detected in active cells within a few seconds. Mechanical stimuli (cutting, puncturing, impact, sonic vibration) initiate the reaction. The immediate cause may be the release of substance(s) from ruptured or injured cells and movement to pit areas. Sometimes there is a secondary phase where callose continues to be deposited as pads or plates on the inner wall surface. The process is sensitive to temperature but not to oxygen. Among chemical stimulants of this phase studied by Dunning, endothal (sodium 3,6-endoxohexahydrophthallate) is especially active. The substance displays a delayed toxic action and induces degenerative changes in the protoplasm. Maestri showed that it can subtly block transport of C^{14}-labeled tracers. Results conform to the view that callose synthesis accompanies protoplasmic changes involving breakdown of barriers and release of active substances. Formation in parenchyma is compared to that in sieve elements.

CURRY, GEORGE M. *See* GRUEN, HANS E.

CURTIS, J. T. *See* MAYCOCK, PAUL F.

CUTTER, ELIZABETH G. University of Manchester. *Formation of Lateral Members.* Of the diverse lateral members of the shoot, only leaves and vegetative and flower buds will be considered. Problems of leaf, and perhaps also bud, formation are closely linked with those of phyllotaxis, the causal interest centering on the factors which determine the characteristic organogenic developments of different parts of the same apical meristem. In some ferns, leaf sites and nascent primordia can be induced to develop as buds by isolating them from the apex by a wide, deep incision, whereas a shallow incision has no such effect. Isolation by four shallow cuts may prevent leaf inception or cause the regression and disappearance of a visible primordium, while a subsequent deepening of the adaxial cut leads to resumption of primordium growth in some instances. Flowers in *Nuphar* and *Nymphaea*, and also occasional vegetative buds in *Nymphaea*, are normally formed in leaf sites; thus the apical meristem forms a sequence of lateral members, some of which are leaves and some buds; but isolation of organ sites or visible primordia did not result in bud formation. However instructive surgical experiments have been so far, some new kind of information, or outlook, is necessary for an adequate understanding of leaf and bud organogenesis.

Dainty, Jack. University of Edinburgh. *Contribution to General Discussion in Symposium on "The Role of Protoplasm in Uptake and Transfer of Ions."* Recent work on ion transport in large single cells of *Halicystis* and various members of the Characeae are summarised and an attempt is made to link these studies with those on higher plants reported in this symposium.

Dainty, Jack. University of Edinburgh. *The Location and Properties of the Donnan Free Space.* The concept and properties of a Donnan Free Space (D.F.S.), and the types of experiment necessary to indicate its properties unambiguously, are outlined. It is concluded from reports in the literature and from experiments to be reported here that most of the D.F.S. is in the cell wall and, specifically, is due to the unmethylated carboxyl groups of the polyuronic acids (pectins) of the wall. Since protoplasm undoubtedly contains a high concentration of indiffusible anions, its contribution to the measured D.F.S., in various types of experiment, is discussed; in this connection the relevant information from plasmolysis and the evidence for and against the existence of a plasmalemma is considered. Even if the protoplasm contributes to the measured D.F.S. in certain experiments, it is doubtful whether its contribution should be included in the tissue *free* space. A physical picture, at the molecular level, of the cell-wall free space is presented which justifies splitting up this free space into a Water Free Space (W.F.S.) and a D.F.S. Finally, some remarks are made about the kinetics of ion exchange between the external solution and the D.F.S.

D'Amato, Francesco. Instituto di Botanica dell'Università, Cagliari, Italy. *Cyto-histological Investigations of Antimitotic Substances and Their Effects on Patterns of Differentiation.* An attempt has been made to analyze some sources of somatic cell variation, resulting from experimental and natural actions on mitosis, in relation to the ensuing patterns of differentiation. The following three essential antimitotic effects have been considered: (1) Preprophase inhibition (or mitostatic action). The cyto-histological consequences of mitosis suppression in both shoot and root tips and in cambial zones have been analyzed. Mitosis suppression by relatively high doses of growth substances has been regarded as one aspect of the two-phase action of these compounds on mitosis. Consequently, consideration has been given to the histogenetic phenomena connected with mitosis stimulation in normally proliferating regions as well as in differentiated tissues (dedifferentiation). (2) Spindle inhibition (C-mitotic action). Polyploidy, aneuploidy, and reduction in chromosome number resulting from suppression and/or disturbances of spindle and centromere activity have been regarded as the most prominent sources of cell variation *per se* and in relation to chimeras and mosaicisms. (3) Cytokinesis inhibition. The need for a detailed study of cytokinesis inhibitors is emphasized for any understanding of the significance of polynucleation in short-lived plant tissues (anther tapetum, endosperm).

Damman, A. W. H. Department of Northern Affairs and National Resources, Canada. *Problems in Classifying the Vegetation of the Boreal Forest.* The species-poor plant communities and the slight differentiation of the vegetation

cover of the boreal forest present special difficulties for a classification. The methods of the Zurich-Montpellier school of plant sociology were tried in studies in the forests of Newfoundland. A slight revision of the original concepts proved to be necessary for their application. It was, for instance, necessary to recognize associations and even higher units which do not have characteristic species. Consequently, more emphasis has to be placed on groups of differential species. Moreover, dominance has often to be used as a differential characteristic on the sub-association level. The use of dominants for classification purposes is, however, limited and depends, in the first place, on the type of dominance. The characteristic species composition is of great importance for characterization and mapping purposes, but cannot be used in the initial stage of classification since the constant species cannot be determined until the types have been established.

DANSEREAU, PIERRE. Université de Montréal. *La Végétation du Canada.* Après un bref examen des flores canadiennes, de leur histoire et surtout de leurs migrations, les grandes régions climatiques seront considérées tour à tour. Pour chacune d'entre elles je tenterai un essai descriptif qui comportera une part d'interprétation et d'intégration dans le contexte plus large des grandes unités (arctique, subarctique, montagnarde, boréale, tempérée, steppique et pacifique), qui débordent le Canada de toutes parts. La toundra a une origine probablement assez récente et s'est trouvée singulièrement morcelée et refoulée au cours du Pléistocène. Les types actuels de végétation — dont un grand nombre se retrouvent en Eurasie — sont conditionnée à l'échelle régionale non seulement par le permafrost mais surtout par la topographie. La savane subarctique qui se compose d'une bande transcontinentale, ininterrompue, est caractérisée par des arbres de taille réduite isolées, groupés en touffes ou clairsemés, au pied desquels des arbustes bas à feuilles coriaces, quelques plantes herbacées et une forte quantité de lichens forment un tapis. Cette formation a son équivalent en montagne, à l'étage subalpin. La forêt aciculifoliée est sans doute la forêt "canadienne" par excellence, puisqu'elle va "a mari usque ad mare." L'uniformité de cette forêt dense est conditionnée par la système du drainage puisque partout où il est bloqué, c'est la tourbière ("muskeg") qui se forme. La forêt pacifique, elle aussi aciculifoliée, mérite d'être considérée à part, car elle bénéficie d'un régime superhumide et par conséquent modéré, le seul qui existe au Canada. La forêt décidue, qui entoure les Grands Lacs et descend le St-Laurent, pour atteindre les Provinces Maritimes a un caractère complètement différent et des affinités chinoises et ouest-européennes. Elle manifeste une pulsation saisonnière dont l'écologie est particulière. La prairie et la steppe occupent deux aires distinctes: l'une, très grande à l'Est des Rocheuses et l'autre dans l'intérieure de la Colombie Britannique. Elles continuent de vastes formations du grassland nordaméricain qui comporte plusieurs phases: haute prairie, prairie moyenne et steppe. Les points de contact entre chacune de ces grandes zones présentent un intérêt particulier. Un examen du dynamisme actuel des associations végétale qui s'y rencontrent et des processus pédogéniques qui les accompagnent nous renseignent sur les tendances présentes du climat lui-même.

DARROW, ROBERT A. Texas A. & M. College. *Aerial Application of Phytocides for Woody Plant Control on Range and Forest Lands.* Broadcast applications of phytocides for the control of competitive woody plants provide an effective tool for improvement and increased forage, livestock, and timber production on range and forest lands. Aerial or foliage spray applications of 2,4,5-T, 2-(2,4,5-

TP) or silvex, MCPA, and 2-4-D and broadcast soil applications of granular herbicides including fenuron and 2,3,6-TBA provide selective control of some species of woody plants and an increase in yield of desirable forage under suitable management. In Texas, aerial spray applications of as little as ⅓ lb./A. of 2,4,5-T ester are used to control mesquite (*Prosopis juliflora* var. *glandulosa*) and root sprouting is suppressed for five to seven years. Rootkills of 70 to 85 per cent of post oak (*Quercus stellata*) and blackjack oak (*Q. marilandica*) result from two yearly sprays totalling 2 to 2.5 lb./A. of silvex or 2,4,5-T ester. Normally increased yields of bluestems (*Andropogon spp.*) and other prairie grasses of this type will amortize the costs of control within a few years. In the Gulf states, release of pine (*Pinus palustris, P. taeda, P. echinata*) for timber production from mixtures with undesirable hardwoods has been achieved without pine damage by aerial spray applications of 2,4,5-T esters at 1.5 to 2 lb./A. A recently developed technique provides 75 to 90 per cent rootkill of post and blackjack oaks on sandy and sandy loam soils by broadcast soil application of fenuron pellets at the rate of 4 lb./A. of active ingredient. Subsequent root absorption of the phytocide with adequate soil moisture and favorable growth conditions results in woody plant control with little or no effect on perennial grasses.

DAVEY, CHARLES B. *See* PAPAVIZAS, GEORGE C.

DAVIDSON, DOUGLAS. Oak Ridge National Laboratory, Tennessee. *Cell Lineages in Meristems of Irradiated Roots.* Chromosome breakage and reunion of broken ends in new combinations result in chromosome rearrangement. During mitosis, in roots of *Vicia faba*, cells with aberrant chromosomes are found following irradiation. Cells with aberrant chromosomes do not always disappear from root meristems; they have been found twenty-one days after X-raying. Studies of roots with cells with aberrant complements are being made in order to determine some of the changes that occur in meristems recovering from irradiation. Roots which have received 600 r grow slowly. Yet roots were found in which there were several cells, each with a similar aberration. It is assumed that all cells with a particular chromosomal change or, more rarely, with a particular double change are descended from one cell damaged by irradiation. The presence in a root of several cells, each with a similar aberration, indicates that some cells undergo a number of mitoses in a period of slow root growth. There is evidence that these cells are responsible for the restoration of meristematic activity and thus for the later growth of the root. Examples of the ways in which chromosome markers are used to follow cell lineage and cell behaviour in meristems will be discussed.

DAVIDSON, J. G. N. *See* KRAJINA, VLADIMIR J., *et al.*

DAVYDOVA, V. N. *See* SHKOLNIK, M. YA., *et al.*

DE FERRÉ, FRANÇOISE YVETTE, and PIERRE ROUANE. Faculté des Sciences, Toulouse. *Formes horticoles de Thuya et Chamaecyparis.* La plus grande confusion règne dans la définition de ces formes dont l'identification se révèle souvent délicate. Elles se répartissent en quatre groupes, qui ne s'excluent pas mutuellement: couleur (glauca), port (pyramidalis), phyllotaxie (lycopodioides), formes juvéniles fixées (*plumosa*). Pour ces dernières toutes les transitions existent entre la forme "ericoide" à feuilles aciculaires, non décurrentes, verticillées; et l'adulte à feuilles squamiformes, opposées-décussées, apprimées, longuement décurrentes. La mise en série peut être faite commodément par les valeurs décroissantes du rapport l/L (longueur de la partie libre de la feuille/longueur totale). A partir du moment où les feuilles, opposées, sont portées sur des ramilles aplaties, on peut déterminer l'espèce, à coup sûr, sous ses différentes formes grâce aux caractères suivants: longueur des entrenœuds; disposition des stomates; nombre, forme, disposition des glandes résinifères; — cellules scléreuses. Une technique nouvelle permet l'examen microscopique de ces caractères en évitant la confection de coupes. Pour les formes éricoides la difficulté reste plus grande, imposant parfois la méthode anatomique. Pour clarifier la nomenclature il serait souhaitable que, d'une espèce à l'autre, les formes qui se correspondent portent le même qualificatif.

DEKKER, J., and PETER A. ARK. University of California. *Enzymatic Inactivation of the Fungicide GS-1 in Orange Rind.* A concentration of 1 p.p.m. of 2-(1′ oxy-2-pyridylthio) imidazoline (GS-1, patent pending Chas. Pfizer and Company, Inc.) kills the spores of *Penicillium* sps. causing citrus fruit rot, yet a cold solution containing 500 p.p.m. fails to control the disease in fruit. However, when detached orange rind is heated to 135°F. before, during, or after treatment, the GS-1 can be demonstrated inside the rind by bioassaying, and a complete protection against fruit rot is obtained. The GS-1 inhibitor in orange rind can also be eliminated by cyanide gas, sodium azide, soaking in water, drying, and lowering the pH which suggests its enzymatic nature. Catalase and cytochrome C do not affect GS-1 *in vitro,* but peroxidase does it slightly. The strongest inactivation is obtained with a pig-heart extract containing cytochrome oxidase. The inactivation greatly increases on addition of MnO_2 whch reportedly may act as an electron acceptor to cytochrome C, thus replacing cytochrome oxidase. Since peroxidase is less sensitive to high temperature, it is suggestive that in the orange rind GS-1 is oxidized by cytochrome oxidase.

DELAMATER, E. D. *See* ECHLIN, PATRICK

DELAMATER, EDWARD D., and P. ECHLIN. University of Pennsylvania. *Observations on the Isolated Nuclei and Chromosomes of Bacillus megaterium by Cytochemical and Electron Microscopic Techniques.* Nuclei and chromosomes of *Bacillus megaterium,* isolated after treatment of the cells with sodium glycocholate and brief sonication, show the same structures and organization that have been observed in stained intact cells, and have been extensively documented by white light microscopy. The sequence of changes during the divisional stages likewise appears to be similar to those previously described, and supports the interpretation that a mitotic mechanism is operative in this bacterium. Chemical evidence indicates that the bacterial chromosomes are chemically complex, containing DNA, RNA, and protein. Cytochemical evidence indicates that the protein contains -SH radicals, suggesting its equivalence to the fibrous proteins of animal chromosomes (Mirsky and Ris; Stedman and Stedman). Preliminary electron microscopy demonstrates and reaffirms the gross nuclear and chromosomal configurations observed by phase contrast and white light microscopy. Further, this instrument resolves the finite fibrous structure of the chromosomal matrix. No evidence is yet available concerning the organizational relationship of the three known chemical constituents.

DELAPORTE, BERTHE. Faculté des Sciences, Paris. *Nouvelles observations sur la structure nucléaire des Bactéries.* De nouvelles observations faites avec des techniques récemment mises au point et comparées avec les techniques communément employées m'ont permis de reconsidérer la structure nucléaire des grandes bactéries. Diverses fixations ont précédé la technique classique de Feulgen, la coloration de Piekarski-Robinow, celle de Piéchaud, qui est une variante du Giemsa et ne nécessite pas d'hydrolyse, l'hématoxyline de Delafield, etc. *Bacillus enterothrix, B. camptospora, B. collini* et de nombreuses autres bactéries plus petites, ainsi que *Spirillum praeclarum* et un autre grand *Spirillum* possèdent le plus souvent leur substance nucléaire sous forme très complexe: une sorte de réseau très fin et serré, occupant la majeure partie de l'espace situé à l'intérieur de la membrane bactérienne. Ce réseau nucléaire est en contact direct avec le cytoplasme, sans qu'une membrane délimite un espace particulier. La division a lieu sans que l'on reconnaisse un arrangement spécial du réseau; seul, un filament chromatique relie les deux moitiés avant qu'elles ne se séparent complètement. Le réseau nucléaire ne fait qu'un ensemble unique entre deux cloisons transversales, alors qu'il se trouve souvent fragmenté en deux ou quatre éléments séparés dans certaines bactéries en cultures. Certaines fixations produisent une simplification du réseau par coalescence qui peut aboutir à la formation d'un filament axial. Les figures observées sont voisines de ce que montrent les coupes de bactéries au microscope électronique.

DELEVORYAS, THEODORE. Yale University. *Studies of North American Cycadeoids: Cycadella.* Among the Wieland fossil cycadeoid collection at Yale University are several stem fragments from the Wyoming Morrison formation which is supposedly Jurassic in age. These and others had been named *Cycadella* by Ward and were supposedly distinct from the Cretaceous *Cycadeoidea.* A morphological study of these forms was made with attention to gross structure and vascular anatomy, including the origin of the vascular system of the cone. As in at least some of the Cretaceous cycadeoideas, there is no separate vascular system to the cones arising from the stele of the stem. Instead, the cone vascularization originates from leaf traces after they are free from the stem stele. There seems to be no justification in setting aside a separate genus for the Wyoming forms which, in other respects as well, have a typical *Cycadeoidea* structure. The generic identity of supposedly Jurassic cycadeoids and Cretaceous ones may help shed some light on problems of dating the Morrison formation more accurately in various parts of the United States.

DERMEN, HAIG. U.S. Department of Agriculture. *Active Central Shoot Apex.* Evidence at hand shows that the central cells at the very apex of the shoot apical meristem actively divide as long as an apical meristem is meristematic. When a natural mutation or an induced cytological change occurs in a centrally located cell at the very apex of the meristematic dome, it results in the development of mericlinal, periclinal, and sectorial chimeras, because of the apical mitotic activity.

DES ABBAYES, HENRY. Faculté des Sciences de Rennes, France. *L'Elément pantropical et ses rapports avec l'élément océanique des flores lichéniques.* Nos voyages dans les régions intertropicales d'Afrique (A.O.F., Madagascar, Réunion) et l'étude de leurs flores lichéniques nous ont conduit à la constatation qu'un

nombre très important d'espèces avait une répartition pantropicale. Alors qu'autrefois on limitait sa documentation bibliographique à la région étudiée, actuellement il n'est plus possible de s'en contenter et on doit rechercher ses documents dans la littérature concernant toutes les régions intertropicales du globe. On s'aperçoit alors que de nombreuses espèces ont été décrites parfois sous cinq noms différents, suivant leur provenance. Des exemples sont donnés. D'autre part ayant étudié depuis longtemps la flore des régions océaniques de l'Europe occidentale, nous avons pu faire un rapprochement entre les espèces particulières à ces régions (élément océanique) et celles des régions intertropicales. En fait, une grande partie de l'élément océanique de l'Europe occidentale provient d'un apport d'espèces à répartition pantropicale. Il en est probablement de même dans les autres régions à climat tempéré de régime océanique du reste du monde. Une liste d'espèces communes à l'élément océanique d'Europe et à l'élément pantropical est donnée. Recherche des causes de cette répartition.

DESIKACHARY, THAMARAPU V. Madras University. *Electron Microscopy and Algal Structures.* High resolution made possible by the electron microscope has probably not been used as much in any other group of organisms as it has in the algae in the elucidation of the structure of the living and non-living parts of the cell. The work of Hustedt, Kolbe, Helmcke and Krieger, Okuno and others on the diatoms, the work of Braarud, Deflandre, and others on the coccoliths, of Manton, Clarke and Parke, Harris, and Bradley and others on the Chrysophycean scales, of Wolken, Steinmann, Mühlethaler, Leyon, Thomas, and others on the structure of the algal chloroplasts, and that of Preston and his collaborators on the structure of the wall in the green algae are some of the most outstanding contributions in the field of electron microscopy and algology. The structure of the diatoms as revealed by the electron microscope has been studied by a number of workers and the knowledge so far accrued from these studies has been reviewed by me in a paper published recently by the Royal Microscopical Society. The place of these new data on the morphology of the frustule in any new system of taxonomy is discussed here. New and unpublished figures of some of the centric and pennate diatoms will be presented.

DESIKACHARY, THAMARAPU V. Madras University. *Sexual Reproduction in Tetrasporidium javanicum Möbius. Tetrasporidium javanicum* Möbius occurs very commonly in India. Iyengar has given a complete description of this alga (Ann. Bot. Lond. *46*:191, 1932). He has recently observed the formation of biflagellate swarmers in this alga (unpublished). Swarmer formation has also been recently observed by the writer. These were biflagellate and behaved as isogametes. Each gamete developed an anterior eyespot even before discharge. Each liberated gamete is naked and has a cup-shaped chloroplast with a central pyrenoid. Discharge of gametes is by the dissolution of the parent mucilage and gametes stream out of the thallus. Sometimes an entire thallus gets converted into gametes. The alga is homothallic. Fusion takes place immediately after pairing and is antero-posterior. The zygotes retain the four flagella for some time. Further development of the zygote was not followed.

DE STIGTER, H. C. M. University of California. *Translocation Studies in a Partially Incompatible Graft.* Studies have been made on the translocation of photosynthates in the graft combination of muskmelon on *Cucurbita ficifolia.*

This graft combination is partially incompatible, that is, the grafted plant grows normally only as long as there is some foliage left on the rootstock. The first symptoms of incompatibility occur specifically in the phloem of the stock, with callose formation and collapse of the sieve tubes. These, and other observations made it desirable to study translocation in this graft. This was done by feeding $C^{14}O_2$ to one leaf of the melon scion and tracing the paths of the resulting labeled photosynthates with special attention to the question whether or not there was any translocation beyond the graft union.

DEVAY, J. E. *See* ZWEIG, GUNTER

DE VOS, MIRIAM P. University of Stellenbosch. *On the Embryology and Relations of the South African Genera of the Haemodoraceae.* Embryological investigations by various workers confirm that the South African genera which have been placed in the Haemodoraceae at one time or another have different affinities and belong to different tribes and even families. Such work supports partly the systems of Bentham and Hooker, of Engler and Prantl, and of Hutchinson. The classification of *Wachendorfia, Dilatris,* and the American genus *Xiphidium* in one tribe is substantiated. This tribe and the Hypoxideae can be grouped in one family. Bentham and Hooker's classification of *Pauridia* in the Hypoxideae is confirmed, but the systematic position of *Lanaria* in one tribe with *Wachendorfia,* etc., is probably not correct. *Lanaria* seems to stand nearer the Tecophilaeaceae but cannot be placed in this family on account of morphological differences. Embryological evidence gives some support to Hutchinson's including *Cyanella* in the Tecophilaeaceae, together with the American genus *Odontostomum* and the African genus *Cyanastrum.* Krause and Hutchinson's classification of *Sansevieria* in the Dracaeneae is confirmed.

DEVRED, RENÉ F. E. Division Botanique INEAC, Yangambi, Congo Belge. *Nouvelles méthodes mécanographiques d'investigations phytosociologiques en forêt équatoriale.* La méthode phytosociologique Zuricho-Montpelliéraine appliquée à la sylve équatoriale qui comporte les formations végétales les plus complexes et des groupements très imbriqués exige pour l'étude de certains types forestiers l'intervention d'une méthode objective relativement au choix des individus d'association. Nous étudions actuellement les données de base et les systèmes pratiques de mécanographie nécessaires à l'édification de cette méthode de travail. Celle-ci doit nous permettre de mieux connaître la valeur et les possibilités sociologiques tant au niveau des espèces que des groupements, d'opérer un choix plus objectif des individus d'association et de faciliter la fastidieuse élaboration des tableaux et éléments du calcul de la synthèse phytosociologique. La méthode actuellement à l'étude comprend: (1) établissement d'une documentation complète des divers critères écologiques et phytogéographiques des espèces et leur codification mécanographique; (2) établissement des fréquences par strates de toutes les espèces dans divers types de forêts définis sur des bases physionomiques, floristiques (dominances) et structurales, et la codification mécanographique des données; (3) confrontation des tableaux de fréquences obtenues par une classification des espèces et leurs regroupements selon les divers critères enregistrés; (4) interprétation du dynamisme spécifique sur la base des fréquences et des dispersions intra- et interstrates; (5) rédaction d'un tableau synthétique final. Si des entités sociologiques

existent réellement au sein des types forestiers étudiés, le regroupement des espèces selon les affinités ou tendances écologiques et historico-génétiques d'une part correspondra nécessairement à un regroupement des fréquences et tendances dynamiques d'autre part localisant ainsi diverses entités sociologiques. Au départ de ces informations se réalisent les travaux de pure phytosociologie. Nous avons actuellement mis au point une méthode mécanographique (I.B.M.) qui permet de réaliser beaucoup plus rapidement et surtout avec plus de précision les tableaux et calculs de synthèse si compliqués à rédiger dans les études phytosociologiques en forêt équatoriale.

DEVREUX, MARCEL. E. de Langhe, INEAC, Yangambi, Congo Belge. *Phylogénèse des bananiers comestibles.* Un schéma d'amélioration des bananiers, par voie générative, est poursuivi à Yangambi depuis 1954. De nombreuses hybridations furent réalisées entre les formes comestibles et les sous-espèces de *Musa acuminata* et *M. balbisiana.* Dirigés comme à Trinidad, les croisements ont donné des hybrides tétraploïdes et diploïdes; puis des triploïdes par recroisements. L'étude de la variabilité des dimensions des grains de pollen chez les bananiers parentaux et hybrides donne une idée très significative de l'importance des anomalies méiotiques et donc de l'éloignements ou de la parenté des génomes rassemblés dans les hybrides. Ces renseignements, joints à des observations phénotypiques détaillées, permettent de préciser les compositions génomiques des bananiers comestibles. Parmi les principaux résultats obtenus, citons: (1) la présence dans un bananier de table (AAA) d'un génome de *M. acuminata* spp. *malaccensis,* prouvée par l'obtention d'un hybride diploïde parfaitement fertile; (2) l'éloignement des génomes *acuminata* et *ornata* donnant des hybrides diploïdes qui, recroisés par un des parents, donnent des tétraploïdes; (3) de nombreux hybrides tétraploïdes obtenus par croisements entre Argent (AAB) et la spp. *malaccensis,* donnent par recroisements des triploïdes AAA et AAB; (4) dans tous les bananiers plantains observés (AAB), un génome A semble provenir de la ssp. *burmannica* forme Long Tavoy; (5) les deux formes Long Tavoy et Calcutta 4, regroupées par N. W. Simmonds dans la ssp. *burmannica,* semblent se différencier suffisamment pour être considérées comme deux sous-espèces; (6) les différentes formes connues — Ceylan, Brachycarpa, et Mindanaensis — pourraient être regroupées, au même titre que les *acuminata,* comme sous-espèces de *M. balbisiana.*

DE WET, JOHANNES M. J. Department of Agriculture, Pretoria, South Africa. *Phylogenetic Position of Endemic South African Grasses.* The South African grass genera *Lintonia* Stapf, *Entoplocamia* Stapf, *Tetrachne* Nees, *Fingerhuthia* Nees, *Lasiochloa* Kunth., *Plagiochloa* Adamson, and *Urochlaena* Nees are classified by various authors either in the tribe Festuceae or in the Chlorideae (*Fingerhuthia*) and Eragrosteae (the others). The first four genera resemble the chloridoid-eragrostoid group of grasses in spikelet morphology, leaf anatomy, epidermal traits, and cytology. Embryo anatomy is of the type described for genera belonging to the tribe Bambuseae and isolated genera such as *Uniola* and *Orthoclada.* For these reasons they may be regarded as relics of the original chloridoid-eragrostoid types. *Lasiochloa, Plagiochloa,* and *Urochlaena* resemble members of the tribe Danthonieae in spikelet morphology, leaf anatomy, epidermis, cytology, and embryo anatomy. For these reasons they should be referred to this tribe.

DEWOLFE, T. A. *See* KLOTZ, L. J.

DE ZEEUW, DICK, and RITZEMA BOSWEG. Institute for Atomic Sciences in Agriculture, Wageningen, Netherlands. *Mobilization of Growth Factors and Flower Induction.* It is reasonable to assume that a series of events is involved in the processes leading to floral initiation, but it is a matter of conjecture where to pinpoint the beginning of these events. However, it seems likely that this point reaches into the vegetative growth period, for it is known that there exists a sort of antagonism between vegetative and generative growth activity. Factors, which promote the vegetative activity, generally inhibit generative activity. The presence of young leaves, especially, is an inhibitory factor. The question whether promotive "stimuli" or the removal of inhibitory factors are responsible for flowering can, therefore, not be fully answered by experimenting with plants in different stages of vegetative activity. For instance, the role which auxin plays in the flowering process changes with the vegetative status of the plant. In the presence of young growing tissue the influence of auxin is changed to the inhibitory direction. It seems worthwhile, therefore, to consider the possibility that floral initiation does not require specific factors but only a mobilization or redistribution of normal growth factors away from the young growing tissue. This means that a more intensive translocation study program, in which radio-active tracers can play an important part, can be very helpful in elucidating the flowering problem.

DICKSON, J. G. *See* ALLEN, O. N., *et al.*

DIMOND, A. E. Connecticut Agricultural Experiment Station. *Systemic and Eradicant Materials for Plant Disease Control.* The synthetic systemic fungicides, the eradicant fungicides, and certain antibiotics are all chemotherapeutants. Antibiotics illustrate well the principles of systemic toxicity for control of plant diseases. They are useful in combating seed-borne diseases because they kill not only superficial but deep-seated pathogens. Some antibiotics are translocated in growing plants and are useful in therapy of bacterial pathogens, rusts, and powdery mildews. The synthetic systemic fungicides are useful in a similar manner and their development has presented many intriguing problems for both the biologist and the chemist. A number of protective fungicides have eradicant properties and, though not necessarily translocated extensively in the plant, they are useful in eliminating infection in an early stage of development. Synthetic systemic fungicides and antibiotics have also proven useful as eradicant materials. The soil fungicides eradicate inoculum in the soil, or, alternatively, eliminate infections in roots. In all these cases, the material must be low in phytotoxicity and high in potential toxicity to the pathogen, and must operate at or close to the court of infection.

DIRKS, H. T. *See* FRASER, D. A.

DIXON, P. A. University College, Ghana. *Reproductive Capacity in Termitomyces striatus* (Beeli) *Heim. Termitomyces striatus* (Beeli) Heim. associated with the "sponges" produced in the underground nests of *Psudocanthotermis militaris* shows two peaks of fruiting associated with the concentration of the annual rains into two periods June and September. Daily fruit body counts made on several areas show that a maximum of three or four fruit bodies may be produced from one sponge though the members of initials may be as high as 250. An index of reproductive capacity can be estimated as a ratio of primordia produced to the final number of fruit bodies. The factors controlling the index are sponge diameter, number of primordia on the sponge, depth, and available water supply.

DIXON, P. S. University of Liverpool. *Morphogenesis in the Florideae.* The external form of the thallus is the principal feature used for taxonomic discrimination in the Florideae. Much of the present taxonomic chaos in that group results from the failure to recognize and interpret the seasonal and environmental modifications of external form. Before such interpretation can be undertaken, the way in which the form of the thallus comes into being must be known. The information available is, at the present time, very scanty; nevertheless, it is possible to elucidate the patterns of development and relate these to the external form of the thallus in a number of notoriously polymorphic genera.

DOMAN, N. G. Academy of Sciences, Moscow. *Investigating the Nature of Early Products of Photosynthesis.* By means of C^{14} and enzymic poisons the existence of a stage of specific unstable CO_2 fixation by photosynthesizing plant leaves has been shown. Determinations have been made of the amount, rate, and character of transformation of the products of this fixation in the light and in the dark. By employing successive exposures of leaves in chambers with labeled and unlabeled CO_2 and the mildest techniques of material fixation and treatment, data have been obtained providing direct evidence of a functioning photosynthetic reduction cycle. It is demonstrated that, under normal conditions of stationary photosynthesis, early labile products are mainly converted into phosphoglyceric acid, which in its turn can transform itself in several directions, but is chiefly reduced. A new reaction has been discovered of CO_2 fixation proceeding at a low intensity simultaneously with CO_2 fixation reaction on ribulosediphosphate and leading to formation of a substance similar to the product of polyphenol carboxylation. The studies of formation dynamics in early intermediate photosynthetic products in various kinds of plants, algae, and bacteria under changing conditions testify to the fact that, in addition to the unity of the main stages in the carbon path, during photosynthesis the specificity of metabolism and the direct dependence on conditions are apparent at the very beginning. Data have been obtained which show the existence of several independent kinds of CO_2 fixation by leaves in the dark, and also data demonstrating the relation of light and dark CO_2 assimilation from the point of view of synthesis of matter. The relation is aided by localization of primary photosynthetic products on the surface of chloroplasts as shown on "mnium" leaves.

DONALD, COLIN MALCOLM. University of Adelaide. *Competition for Light in Pastures.* There are many environments in which, for at least a part of the year, water and nutrients are adequate for pasture growth; in these circumstances, competition for light becomes the dominant factor governing the growth of the pasture. When the Leaf Area Index (ratio of leaf area to ground surface, L) is low, much light energy reaches the soil surface and is lost for photosynthesis. As the leaf area increases, the absolute rate of growth of the pasture also increases, reaching a maximum when the lowest leaves still receive sufficient light to show a positive balance of photosynthesis over respiration. As the leaf area increases further, the lowest leaves make a negative contribution and the absolute rate of growth of the pasture declines. The leaf area reaches a maximum value when the rate of production of new leaf area equals the rate of senescence of old leaf area. This concept of a ceiling leaf area has considerable implication both in pasture and in crop production.

DORF, ERLING. Princeton University. *The Fossil Forests of Yellowstone Park, Wyoming.* Re-study of the "Petrified Forest" of Yellowstone Park and of new collections of fossil leaves, cones, and petrifactions from the volcanic rocks of the region has been made under a National Science Foundation grant. The petrifactions are being studied by Dr. Richard Scott of the U.S. Geological Survey. Noteworthy features of the fossil forests include: (1) about 27 forests, one above the other, were successively buried in a vertical sequence of 1,650 feet of volcanic ash beds and breccias; only 12 successive forests were previously reported; (2) most of the petrified stumps are still standing upright in the position of original growth of the ancient trees; (3) associated ash beds have yielded hundreds of beautifully preserved fossil leaves, twigs, needles, and cones of over a hundred different species. The buried forests were apparently a mixture of warm temperate forms, such as *Sequoia, Pinus, Platanus, Magnolia, Juglans, Cercidiphyllum,* and *Castanea,* and of subtropical forms, such as *Persea, Ficus, Columbia,* and *Laurus.* The assemblage is interpreted to indicate a warm lowland region with annual rainfall of 50 to 60 inches. Its age is now believed to be Eocene, roughly 45,000,000 years old, instead of Miocene as originally dated.

DORMAN, KEITH W. *See* SQUILLACE, A. E.

DOTY, MAXWELL S. University of Hawaii. *Aspects of Pioneer Population Development on Newly Cooled Lava Flows.* The 1955 eruption of the volcano Kilauea in the Hawaiian Islands sent three separate streams of lava into the sea. Thus, there were formed natural pioneer sterile surfaces, the biological and physical changes on which were followed by making observations for a period of two years. Several of the observed phenomena are interpreted as pioneer colonization, pioneer community formation, disclimax, and succession. The observations leading to these interpretations will be illustrated.

DOUBINGER, JEANNE M.TH. Institut Catholique de Toulouse. *Observations sur la flore autunienne.* Un inventaire détaillé de la flore autunienne a été fait à Autun et dans d'autres bassins du Massif-Central français: Blanzy, Lodève, Détroit de Rodez, Brive, etc. Des comparaisons ont été réalisées, en outre, avec des ensembles de même âge provenant d'Allemagne (Thuringe, Saxe, Sarre, Palatinat), de Bohême-Moravie, du Portugal, du Maroc. Les éléments essentiels de cette flore sont des Ptéridophyllées (Fougères ou Ptéridospermées) appartenant en particulier aux genres *Callipteris, Odontopteris, Taeniopteris*; des gymnospermes se partageant entre les genres *Lebachia* et *Ernestiodendron.* Parmi les éléments accessoires il faut distinguer: (1) des reliquats de la flore stéphanienne: *Articulées* (sphenophyllum, Calamites) *Lycopodiales* (Sigillaria), Ptéridophyllées, Fougères et Ptéridospermées (*Pecopteris, Dicksonites, Pseudomariopteris, Sphenopteris*); (2) des précurseurs de la flore mésozoique: *Ptérophyllum, Baiera, Sphenobaiera, Ginkgophyllum, Ginkgoites* et des formes "incertae sedis" apparentées soit aux Cycadales ou aux Bennettitales, soit aux Ginkgoales? Dans l'ensemble, les caractères floristiques témoignant d'un climat plus sec qu'au Stéphanien correspondant à une réduction sensible des lagunes qui n'ont toutefois pas entièrement disparues. La différenciation locale des associations végétales est toutefois remarquable: elle résulte vraisemblablement de l'isolement relatif et de la dispersion des bassins: végétaux palustres gymnospermes des régions plus sèches prédominent alternativement. A ces influences fondamentales se sont superposés les effets de facteurs secondaires (altitude, orientation, pluviosité) déterminant souvent de véritables climats locaux. Il en résulte aussi qu'une même espèce végétale se présente souvent, suivant les régions, sous des variétés différentes.

Dowding, E. Silver. University of Alberta. *Nuclear Streaming in Gelasinospora.* Under some conditions, large numbers of nuclei of *Gelasinospora tetrasperma* travel through the mycelium for long distances, passing from one cell into the next via the septal pore. They are carried by the streaming cytoplasm at speeds as high as 40 mm. per hour. Under other conditions, the moving cytoplasm leaves all the nuclei behind, fixed in the thin cytoplasmic lining of the cell wall. Nuclei have been observed to stream in certain mated homokaryons but not in unmated ones. A mechanism for nuclear streaming is suggested.

Downs, R. J. U.S. Department of Agriculture. *Influence of the Photomorphogenic Reaction on Elongation.* Brief exposures to light, especially red, inhibit hypocotyl and epicotyl elongation and induce expansion of leaves of dark-grown seedlings. The potential effect of red irradiation can be reversed by a subsequent exposure to far-red. Elongation of light-grown seedlings, both herbaceous and woody, is also controlled by this red, far-red reversible photoreaction. A brief exposure to far-red at the close of each light period promotes stem elongation in proportion to the duration of darkness following irradiation. Elongation of the flower-bearing stem of long-day plants is also promoted by far-red at the close of each light period provided flower initiation has occurred. The photoreaction thus appears to operate in two ways simultaneously. Far-red tends to retard flowering of long-day plants by reversing the effect of the red interruption while at the same time promoting stem elongation and consequently promoting flowering. These responses are induced by low energies and show that the pigment is not destroyed by light but is present and capable of operation at any time.

Droop, M. R. Marine Station, Millport, Scotland. *Chemical and Ecological Considerations in the Design of Synthetic Culture Media for Marine Algae.* Literal imitation of natural sea water for cultivating algae has tended to give way to reproduction of its functions. Thus latitude regarding major ions is comparatively great; artificial pH buffers without the disadvantage of gas-dependence replace the natural bicarbonate system; single chelating agents replace multitudinous natural organic compounds for trace metal control. In cultures chelation by citrate gave way to the use of amines (e.g. EDTA), but citrate has advantages over EDTA as regards lack of toxicity and sensitivity to Ca and Mg concentration (a consideration when varying salinity). Natural minor organic constituents have further physico-chemical functions, for example, redox poising. But the degree of refinement to be incorporated in media depends on their use (e.g., pelagic species greater than littoral species, bacteria-free cultures greater than unialgal cultures). Many physico-chemical requirements are artifacts of cultivation. Furthermore, culture studies may define these requirements but do so only in relation to conditions of cultivation; functions may be defined, but no knowledge is gained about the performers of the functions in nature.

Droop, M. R. Marine Station, Millport, Scotland. *Nutrition of a Phagotrophic Marine Dinoflagellate.* The phagotrophic colourless marine dinoflagellate *Oxyrrhis marina* Dujardin can be cultivated indefinitely in the absence of other organisms of all kinds, provided it is supplied with certain vegetable lipids. Development of culture media in which all the water-soluble components are defined enabled the water-soluble nutrient and absolute growth-factor requirements to be ascertained. The media were equivalent to a half-strength artificial sea water buffered with glycylglycine and histidine with a trace metal mixture chelated with histidine and citric acid. Acetic acid or ethanol (not any carbohydrate or the carbon of amino acids) serves as carbon source, and alanine, proline or especially valine (not No_3^-, NH_4^+, or urea or other amino acid) as nitrogen source. Auxotrophic requirements are met by the thiazole moiety of thiamine, vitamin B_{12} (near Ochromonas specificity), and biotin. Although *O. marina* is superficially animal-like, its pattern of nutritional requirements and abilities in the absence of phagotrophy is more typical of other lower algae than of Protozoa.

Dropkin, Victor H., and P. E. Nelson. U.S. Department of Agriculture and Cornell University. *The Pathogenicity of Meloidogyne sp. (Root-knot Nematodes).* Review of the literature shows interaction between three variables in determination of the pathogenicity: host heredity, parasite heredity, and the conditions of infection. Detailed examination of the situation in nineteen varieties of soybeans (*Glycine max* (L.) Merr.) infected with *Meloidogyne incognita* Chitwood, 1949, and *M. incognita acrita* Chitwood, 1949, indicates a correlation between tissue responses to the nematodes and the parasite's success in reproduction. Galls are formed by hyperplasia and hypertrophy of pericycle tissue. Giant cells in hosts which support the parasite are large and multinucleate, with clear, evenly granular cytoplasm and heavy walls showing thick deposits containing cellulose. Giant cells in hosts which do not support the parasite vary from the type described above to small, malformed, necrotic giant cells. Necrosis of giant cells and other root tissues is a common but not universal feature of such hosts. Variable degrees of disturbance of normal root tissue differentiation have been noted, ranging from minor disturbance to complete replacement of vascular tissues by undifferentiated parenchyma. A series of timed infections forms the basis of description of events leading to giant cell formation.

Ducet, Gaston. Station Centrale de Physiologie Végétale, C.N.R.A., Versailles. *Mécanisme respiratoire des feuilles.* De nombreux enzymes ont été trouvés dans les homogénats de feuilles. Par contre, dans les feuilles intactes, la détermination des chaînes respiratoires ne repose que sur l'action d'inhibiteurs plus ou moins spécifiques. L'étude de la respiration montre que le ou les enzymes respiratoires sont peu sensibles à une tension d'oxygène supérieure à 5 per cent. En-dessous de cette valeur, la respiration décroît rapidement et le quotient respiratoire peut devenir nettement supérieur à l'unité. Le mélange (CO 95, O_2 5) inhibe la respiration des jeunes feuilles; cette inhibition est réversible à la lumière. Pour les feuilles adultes, ce mélange semble assez souvent exalter la respiration, en même temps qu'il se produit une glycolyse aérobie d'intensité variable. Cette glycolyse induite est supprimée par la lumière. L'exaltation du QO_2 est maximum pour un mélange (CO 98, O_2 2) comparé au mélange (N_2 98, O_2 2). Quand le mélange contient moins de O, 5 O_2, la respiration est inhibée. La respiration des feuilles adultes de plantes carencées en fer est sensible au mélange (CO 95, O_2 5). Après absorption de bisulfite par les feuilles, l'acide glycolique s'accumule à la lumière, indiquant la possible participation de la glycolicoxydase dans la respiration. Toutefois, l'utilisation de l'oxygène lourd a montré que la respiration des feuilles vertes était la même à la lumière et à l'obscurité. Les mitochondries de feuilles oxydent le succinate avec un P/O pouvant dépasser 1, 5, dépendant de l'espèce végétale et des conditions de préparation. Système mitochondrial et cytochrome oxydase doivent avoir un rôle primordial pour la respiration des feuilles vertes puisque la phosphorylation oxydative est le seul système connu de mise en réserve d'énergie dans la respiration.

Duddington, C. L. The Polytechnic, London. *Predacious Fungi Antagonistic to Microscopic Animals in Soil.* Soil predacious fungi belong mainly to two major groups: the Zoopagales and the predacious Hyphomycetes. The former prey chiefly on soil Protozoa, especially amoebae, while the latter mainly attack eelworms. The Zoopagales show little morphological specialization for predacious life but are highly specialized physiologically. Most appear to be obligate predators. The predacious Hyphomycetes show remarkable morphological adaptations for the capture of prey, including sticky networks, sticky knobs, and non-constricting and constricting rings. Physiologically they are in many ways less specialized than the Zoopagales in that they are facultative saprophytes capable of living independently of their prey without apparent privation. Their predacious habit probably gives them a biological advantage over other soil fungi under certain conditions. In the formation of their trapping organs they show interesting responses to the presence of diffusible substances emitted by their prospective prey. Little is known about the ecology of the Zoopagales, except that they are of common occurrence in soil and elsewhere. They appear to be host-specific to a high degree, but confirmation is needed of this. The eelworm-trapping Hyphomycetes have been more studied, both in the laboratory and in the field, and recent experimental work indicates that as natural enemies of eelworms they are effective in reducing eelworm numbers in the soil, at least where conditions are favourable for their activity.

Dugger, W. Mack, and T. E. Humphreys. University of Florida. *The Effect of Boron on the Biosynthesis of Sucrose.* Boron increased the incorporation of C^{14}-hexose into sucrose by leaf homogenates when UTP, hexokinase, ATP, phosphoglucomutase, and inorganic pyrophosphatase were included in the incubation mixture. In an attempt to locate the site of boron action, purified preparations of the enzymes involved in sucrose synthesis were made. These preparations catalyzed reactions 1 and 2: (1) UTP + glucose-1-P $\rightleftharpoons$ UDPG + pyrophosphate; (2) UDGP + fructose $\rightleftharpoons$ sucrose + UDP. Assay for these reactions indicated that UDPG synthesis was slightly stimulated by borate (reaction 1), whereas sucrose synthesis from UDPG and fructose was inhibited (reaction 2). When the enzyme preparation was incubated with UTP, glucose-1-P, and fructose, boron greatly stimulated the synthesis of sucrose. This was especially true if ATP was present in the reaction mixture. Further investigation revealed that UDP-kinase was present in the enzyme preparation and was catalyzing reaction 3: UDP + ATP $\rightleftharpoons$ UTP + ADP. With borate in the reaction mixture the UDP seems to be recycled to UTP which in turn is re-united in reactions 1 and 2. These findings are discussed with respect to the role of boron in sucrose metabolism in plants.

Duncan, Catherine G. U.S. Forest Products Laboratory. *Microscopical Studies of Wood Deteriorated by the Lower Funi.* Pure cultures of the lower fungi, representing more than 20 genera of Fungi Imperfecti and four of Ascomycetes, isolated from timber showing the soft rot type of deterioration caused decay in test blocks of both hard and softwoods. Microscopical observations of sections from wood with different degrees of attack are described and illustrated by photomicrographs. These show the changes that occur in the fungus and the wood as the hyphae pass through pit orifices and bore holes, and as they produce the unique cavities parallel to the fibrillar orientation within the secondary wall.

Duncan, J., and Henri Généreux. Ministère Fédéral de l'Agriculture, Canada. *La Transmission par les insectes de l'agent pathogène de la flétrissure bactérienne de la pomme de terre, Corynebacterium sepedonicum.* Des études faites sous cages, en serre, indiquent que des insectes du feuillage de la pomme de terre tels que le doryphore, la cicadelle, l'aphrophore, la punaise terne et le puceron de l'espèce *Myzus persicae* (Sulz.) peuvent vicarier l'agent pathogène de la flétrissure bactérienne. L'infection a été obtenue par l'inoculation de plantes saines, soit avec des extraits d'insectes broyés ayant séjourné sur des plantes malades, soit avec des extraits de feuilles ou de plantes lyophilisées ayant hébergé des insectes contaminés. L'infection a aussi été effectuée sous cage par le libre mouvement des insectes d'une plante malade à une plante saine. A l'exception de l'altise, tous ces insectes ont pu infecter, en serre, des pieds de pommes de terre qui produisirent un certain nombre de tubercules infectés ne manifestant aucun symptôme. Le doryphore a été le seul insecte capable d'infecter des plantes dont les tubercules filles ont parfois donné naissance à des tiges qui flétrirent.

Dunn, David Baxter. University of Missouri. *Breeding Systems Existing in the Genus Lupinus (Fabaceae).* With the same general floral mechanism the species of *Lupinus* studied in North America employ reproductive processes ranging from obligate self-pollination to almost self-sterility. Most of the annual plants tested have been self-compatible and many are almost obligate selfing. One annual has been found which is almost self-sterile. The perennial species studied to date generally require insect aid. One species has been found which is almost self-sterile. Most of the perennials demonstrated a preference for cross-pollination. Some species of perennials have sterility barriers with other species, but most of those studied permit some amount of introgression. One species permitted introgression with several others only in one direction. A relatively large part of the genus appears to be in an active, dynamic state from an evolutionary standpoint.

Durmishidze, S. V., and O. T. Khachidze. U.S.S.R. *Free Amino Acids in the Grapevine.* In the grapevine roots in which 15 to 40 per cent of total nitrogen is represented by amino acids and amide, there were found: glycine, alanine, cystine, methionine, valine, leucine, amino butyric acid, aspartic and glutamic acids, lysine, arginine, phenylalanine, tyrosine, tryptophane, histidine, proline and glutamine. Aspartic acid, glutamine, and methionine are quantitatively prevailing. During the vegetative period, the total amount of amino acids and amide decreases; their proportion also undergoes alterations; the amount of aspartic acid considerably increases. In the grapevine sap in which 6 to 25 per cent of total nitrogen is represented by amino acids and amide, there were found the same amino acids and glutamine. During the vegetative period, the over-all amino acid content in the sap decreases; their proportions considerably alter at the same time. The amount of aspartic acid increases particularly. Grapevine shoots and foliage do not differ from the roots in their amino acid and amide, glutamine, and methionine. The amount of amino acid in the xylem is higher than that in the phloem. In the buds, pollen, and callus, there were found from fourteen to seventeen amino acids and glutamine. The composition of the sap and organs of grapevine with respect to their amino acid and amide, and their conversions during vegetation show that amino acid biosynthesis proceeds mainly in the roots of the vine grape.

Dutta, S. K., C. V. Hall, E. G. Heyne, and E. D. Hansing. Kansas Agricultural Experiment Station. *Nutritional Control of Pathogenicity of Colletotrichum lagenarium Ell. and Halst.* Nutritional mutants were induced with ultraviolet light from a standard virulent strain of the fungus which causes anthracnose of cucurbits. Certain avirulent mutants became virulent temporarily, producing clear anthracnose symptoms within seven to ten days, when histidine, serine, leucine, isoleucine, inositol, and proline were supplied in aqueous solution to the surface of the leaves of inoculated Black Diamond watermelon seedlings. However, virulence of non-pathogenic mutants which require pyrimidine could not be restored. All mutants except those requiring pyrimidine grew in whole tissue homogenates of all resistant and susceptible varieties tested. But, differential growth responses of the mutants were observed when placed in extracts from the epidermal layers of stems and leaves of the different varieties. The fungus penetrates the cuticle and apparently utilizes epidermal tissue as nutrition for initial growth and establishment in the host. These observations support the hypothesis that mutants were avirulent because of an inadequate nutrition supply or effective inhibition at the site of infection.

Dwyer, John D. *See* Fasbender, M. Veronica

Eames, Arthur J. Cornell University, Ithaca, New York. *The Morphological Basis for Paleozoic Origin of the Angiosperms.* Comparative morphology strongly supports the theory that angiosperms are geologically much older than formerly believed — that they arose as early as the Late Paleozoic. Fossil pollen, wood, and leaf impressions are known from the Jurassic and Triassic. Simplicity of form is now recognized as frequently advanced and characteristic of highly specialized taxa. Critical, thorough studies of the Ranales show that the primitive flower was doubtless bisexual, without typical perianth, with simple, laminar sporophylls, and pollination by beetles. The establishment of unisexuality and dioecism, accompanied by pollination by other insects – with the development of nectaries – and then by wind, and the elaboration of the simple sporophylls were major advances that must have required long periods of time. Anther and filament were differentiated; the sunken, wall-less sporangia were protected and raised to positions more favorable for pollination. The long ventral stigmatic crest was shortened and raised on a style. These steps had been taken before the Lower Cretaceous when the flora was already "mature"; a long period of specialization must have preceded that flora. Wall-less, sunken sporangia, fern-like vessels, and amphiphloic steles suggest Late Paleozoic eusporangiate ferns – perhaps homosporous – as ancestral stock for angiosperms.

ECHLIN, P. *See* DELAMATER, EDWARD D.

ECHLIN, PATRICK, and E. D. DELAMATER. University of Pennsylvania. *The Cytochemistry of the Nucleus of Bacillus megaterium.* Treatment of *Bacillus megaterium* with sodium glycocholate clears the cells and makes the organism more susceptible to disruption by sonication. Differential centrifugation of the cell fragments permits the isolation of a nuclear fraction which is made up of DNA, protein, and RNA, all of which are recoverable. Both time and temperature are critical during the isolation procedure, as the nuclear material is in an extremely fragile form. The effect of different buffers has shown that the integrity of the isolated structures is dependent on the ionic environment. Although glycocholate may cause a condensation of the nuclear material, comparable structures have been isolated from untreated cells, suggesting that glycocholate treatment does not constitute a serious cytological problem. Viscometry studies and UV spectrophotometric analysis indicate that both the glycocholate treatment and the sonication levels used do not cause any significant depolymerization of the DNA. Evidence suggests that the site of action of the glycocholate is on the capsule and cell wall of the organism. The isolated nuclei stain with recognized nuclear stains, and are comparable to the structures seen in intact cells. Preliminary electron microscopy studies of the isolated material corroborates the light microscopy findings. The current status of this work will be presented.

EDGREN, J. W. *See* MCNABB, HAROLD S., *et al.*

EDITH, R. *See* KAPICA, LUCIA, *et al.*

EDWARDS, G. A. *See* EDWARDS, M. R., *et al.*

EDWARDS, M. R., G. A. EDWARDS, and E. L. HAZEN. New York State Department of Health. *Ultrastructure of Several Dimorphic Pathogenic Fungi.* Thin sections of the yeast phase of *Histoplasma duboisii*, *H. capsulatum*, and *Blastomyces dermatitidis*, and of hyphae and spores of *H. capsulatum* have been examined in the electron microscope. All cells show highly differentiated nucleus, cytoplasmic matrix, endomembrane systems, and cell walls. Capsular material is not present. In culture, *H. duboisii* and *H. capsulatum* appear similar in structure and size; in mouse spleen, *H. duboisii* is five times the size of *H. capsulatum* and provokes a more intense host cell reaction. Budding in both types of *Histoplasma* consists of migration of mitochondria and cytoplasmic matrix to the bud, thence nuclear migration and division, and lastly formation of a division plate by centripetal invagination of plasma membrane. Splitting along the plate occurs only after the daughter cell has mature intracellular components. Mycelial cells are characterized by proliferation of endomembranes and fat deposition. Tuberculate spores have a complex laminated cell wall, small nucleus and cytoplasmic organelles, and abundance of fat. *Blastomyces* possesses a highly evolved endomembrane system linking plasma membrane, mitochondria, and the several nuclei. The cell wall is thick and laminated. The micromorphology of double budding will also be illustrated.

EHRENDORFER, FRIEDRICH. Botanisches Institut der Universität Wien. *Polyploidie, Hybridisierung und Evolution: Ergebnisse vergleichender phylogenetischer Studien an Galium, Knautia und Achillea.* Ein phylogenetischer Vergleich verschiedener hemikryptophytischer, allogamer Eupolyploid-Komplexe (2x–4x–6x–8x–10x) aus gemässigten Breiten ergibt für die Gattungen *Achillea* (16 Arten), *Galium* (41 Arten) und *Knautia* (12 Arten) viele allgemeine Uebereinstimmungen: Unter den zahlreichen Polyploidsippen spielen reine Autopolyploide nur eine ganz untergeordnete Rolle, meistens handelt es sich um hybridogene Polyploide. Die Rate der Polyploiden-Produktion (besonders über unreduzierte Eizellen bzw. Chromosomenverdopplung in Zygoten) ist nach Hybridisierung erhöht. Primär entstehen hybridogene Polyploide zwischen diploiden Arten, Unterarten etc., sekundär besonders nach Kreuzungen zwischen verschiedenen Auto– bzw. Allopolyploiden. Multivalent– und Univalentbildung wird trotz weitgehender Genom-Homologien durch verschiedene cytogenetische Steuermechanismen hintangehalten. Die von diploiden Ausgangssippen übernommenen Kreuzungsbarrieren erfahren mit steigender Polyploidie eine fortschreitende Abpufferung. Durch Hybridisierung zwischen verschiedenen Ploidiestufen (über unreduzierte Eizellen bzw. aneuploide Zwischenformen) wird das Genmaterial von isolierten, reliktären, diploiden "Basissippen" schrittweise in stark hybridogene, hochpolyploide, agressive "Dachsippen" verlagert. Die selektive Ueberlegenheit der Polyploiden beruht auf ihrem Hybridcharakter (Biotypenreichtum!), sie sind gekennzeichnet durch grössere Wanderfähigkeit (z.B. bevorzugte Besiedlung postglazial freigewordener Räume) und durch Eindringen in junge Biozönosen (z.B. Klimax-Komplexe). Das Merkmalsspektrum der Polyploiden liegt im wesentlichen zwischen dem der Ausgangssippen; ihre spontane Mutationsrate ist gesenkt, die Differenzierungsphase dementsprechend ± blockiert. Nach verstärktem Einbau von Kreuzungsbarrieren auf der Diploidstufe abgeleiteter Formenkreise stellt Polyploidie aber immerhin einen Ausweg in die Hybridisierungsphase dar.

EHRENREICH, J. H. *See* AIKMAN, J. M.

EIDELMAN, Z. M. *See* SAPOZHNIKOV, D. I., *et al.*

EKSTRAND, HARRY E. G. Statens Växtskyddsanstalt (Swedish Plant Protection Institute), Stockholm. *Phytopathological Aspects of the Overwintering of Cereals and Grasses in Northern Europe.* Climatic conditions are both the direct and indirect cause of winter damage to overwintering crops. Indirectly, the climate may cause damage by creating favorable conditions for parasitic, low-temperature fungi, and to these we must ascribe the most important winter injuries to ground crops. The low-temperature fungi may be classified as saprophytes, parasites, and hyperparasites. Some of the parasites under certain conditions may have a saprophytic stadium. Damage is caused by different fungi belonging to the ascomycetes or hymenomycetes. The most important of these are *Fusarium nivale* (Fr.) Ges., *Sclerotinia borealis* Buk. et Vleug., and some *Typhula* species, especially *T. borealis* Ekstr., *T. itoana* Imai and *T. hyperborea* Ekstr. These species vary in their specialization in relation to the host species. The hyperparasites, belonging only to the genus *Mitrula*, affect some of the *Sclerotinia* and *Typhula* species. They are very specialized but have no direct effect on the overwintering of cereals and other grasses.

EL-ANI, ARIF S., and L. S. OLIVE. Columbia University. *Further Studies on the Genetics of Sordaria fimicola.* Genetic investigations on the homothallic fungus *Sordaria fimicola* have been continued with additional mutants obtained by X-irradiation. More than twelve loci that affect ascospore color, morphology, fertility, and rate of growth were studied in all possible crosses. It has been found that a number of mutant loci may cause self-sterility. Crosses involving pairs of these self-sterile mutants frequently result in perithecial production. The progeny from the hybrid asci contain both sterile cultures and self-fertile recombinants, showing that the loci are non-allelic. Of particular interest is locus *st4* which induces complete sterility and affects ascospore color. It can be distinguished readily from all other self-sterile mutants thus far obtained by the formation of small and uniform spherical bodies, the protoperithecia. The occurrence of linkage relationships has been demonstrated for the first time in *Sordaria fimicola.* Two linkage groups have so far been found. The first is between the *st4* locus and the *o* locus, which affects ascospore color. The second is between the *m* locus which causes the ascospores to coalesce with each other and with the ascus wall, and locus *a-1*, which causes ascus abortion. In heterozygous asci, however, ascospores bearing the factor *m* are normal and can be distinguished from wild-type ascospores by their golden color.

EL-HELALY, A. F. University of Alexandria, Egypt. *Review of the Current Status of Research in the Agricultural Botany Department, University of Alexandria.* A review will be given of the work done by the staff members of the Agricultural Botany Department, Alexandria University, Egypt, U.A.R., either individually or as co-operative projects, during the period 1954 to 1958. A brief summary of each paper is given separately. Citation of the author's name and publishers is also given for the published papers. Otherwise, the unpublished work is referred to as unpublished material.

ELLIOTT, R. F. ***See* FRENCH, C. S., *et al.***

ELSAKOVA, T. N. ***See* KONAREV, V. G., *et al.***

EMBLETON, T. W. *See* LABANAUSKAS, CHARLES K., *et al.*

EMERSON, RALPH, and H. C. WHISLER. University of California. *The Nature and Relationships of Oedogoniomyces. Oedogoniomyces lymnaeae* Kobyashi and Ookubo is a saprophytic, aquatic Phycomycete first described in 1954 from Japan. The thallus is an unbranched filament with basal holdfast. Apical zoosporangia, formed in basipetal succession, release zoospores by circumscissile dehiscence (as in *Oedogonium*). Zoospores are posteriorly uniflagellate and may have a nuclear cap. Further collections of this fungus were made by the authors in 1956-7 in the Central American republic of Costa Rica. Pure culture isolations have permitted detailed studies of the morphology and physiology of this unusual genus. The present paper is devoted to a consideration of the possible relationships of *Oedogoniomyces*. Its discoverers placed it in the Blastocladiaceae because of its chitinous walls and characteristic zoospores. However, the distinctive nature of the thalli, the absence of resistant sporangia on these thalli, and the peculiar method of zoospore release, all argue against such a relationship. On the other hand, the mono-axial filament with basal holdfast is the distinguishing feature of two orders of generally neglected fungi, the Eccrinales and the Amoebidiales. Analysis of the similarities and differences between *Oedogoniomyces* and the eccrinids is instructive, therefore, and may provide a basis for recognizing the true relationships of these forms and their correct position among the Eumycophyta.

Emmert, Fred H. University of Connecticut. *The Bearing of Ion Interactions on Tissue Analysis Results.* Evidence is abundant to indicate that nutrients are not altered in a tissue in a singular and isolated manner but that secondary changes occur in contents of other dissimilar ions. Accumulation of a nutrient is thus enhanced or depressed, depending on the content of other nutrients in the tissue. Such nutrient or ion interactions exert a powerful influence on plant nutrition quite distinct from the more commonly recognized forces of nutrient availability and growth, and must be considered as a separate entity in the evaluation of tissue analysis results. Three possible explanations are proposed for the operative mechanism of ion interactions: (1) ions directly influence uptake of one another at the root membrane level, and such effects are registered in the plant as a whole; (2) differential loss occurs from plant roots to the external medium setting up interactions which are reflected in the plant proper; and (3) ion interactions result from a redistribution of nutrients among various tissues within the plant, and do not involve differential uptake or loss. Studies were conducted to investigate the comparative validity of the three propositions. Considerable redistribution of nutrients was noted within young apple trees grown under different K and Mg regimes in hydroponics culture. Treatments also affected total uptake of some nutrients by the plant. Results suggest that both nutrient redistribution and differential uptake are involved in the ion interaction phenomenon. The bearing of nutrient loss from plant roots on ion interactions was studied with radioactive tracers, but results are not conclusive. Size of P^{32} loss to single salt solutions was of doubtful significance, while considerably greater loss occurred to anion resins. No differential effect on root loss of P^{32} by various ions antagonistic to phosphorus was noted.

Emmons, Chester W. National Institutes of Health, Bethesda, Maryland. *Cryptococcus neoformans and the Pigeon* (*Columba livia*). Virulent strains of *Cryptococcus neoformans* have been isolated from nests and droppings of the pigeon (*Columba livia*) regularly and in widely separated geographic areas. In recent continuing investigations of this association, *C. neoformans* has been isolated from cumulative fecal deposits of many years in attics of old buildings which shelter pigeons. Some of these buildings resemble closely those described in medical literature as the sources of an acute respiratory infection in men who wrecked them. These focal outbreaks ("epidemics") of pneumonitis have been retrospectively diagnosed histoplasmosis, but Histoplasma has not been isolated from nests or fecal deposits of pigeons on upper floors of buildings where it has been sought. *Cryptococcus* is regularly present in such material and it must be assumed that the men involved in these episodes were heavily exposed to *Cryptococcus*. The evidence strongly suggests that certain focal outbreaks ("epidemics") of pneumonitis diagnosed as histoplasmosis may have been actually benign, acute pulmonary cryptococcosis erroneously diagnosed histoplasmosis because of non-specific serologic reactions.

EMMONS, CHESTER W. National Institutes of Health, Bethesda, Maryland. *Prevalence of Cryptococcus neoformans in Pigeon Excreta.* Virulent strains of *Cryptococcus neoformans*, similar in all respects to those isolated from fatal human infections, are present in a high percentage of specimens of pigeon excreta in widely separated regions of the world. The fungus is found in excreta in old nests and under roosting sites without admixture of soil being necessary for its growth. The pigeon itself is not a host. New data on the frequency and distribution of this association will be presented. The public health significance of this association and its probable relation to certain localized outbreaks of pneumonitis in man will be discussed.

ENGELBRECHT, L. *See* MOTHES, K.

ENNIS, HERBERT L. *See* SUSSMAN, RAQUEL R., *et al.*

EPSTEIN, EMANUEL. University of California. *Discussion of Current Views on the Active Accumulation of Ions.* Until recently, the membrane at the external surface of the protoplast — the plasmalemma — was considered by most workers in this field to be the one concerned with the active accumulation of ions. This widely accepted view has been re-examined in recent years, and there is now no general agreement concerning the localization of the active ion transport processes in cells and of the pools of ions before and after passage through the active transport mechanism. Evidence bearing on these problems includes: (*a*) the finding that appreciable and measurable fractions of the total volume of cells and tissues are reversibly accessible to ions by diffusion ("outer" or "free" space); (*b*) findings linking the process of ion absorption with the cytochrome system and hence focussing attention on the mitochondria; (*c*) results suggesting that the external pH prevails at the sites at which ions are bound by the active transport mechanism; (*d*) experiments showing that pools of metabolically accumulated ions (presumably in the vacuoles) may be by-passed by other ions of the same ionic species absorbed subsequently. The contributions of the participants in the symposium will be discussed.

EPSTEIN, H. T. *See* SCHIFF, J. A., *et al.*

ERDTMAN, GUNNAR. Palynological Laboratory, Stockholm-Solna. *Palynological Trends in Palaeobotany.* A review is presented of some developments in palynology during the past forty years, from the application of pollen analysis in bog-stratification studies to the use of electron microscopes in deciphering the sporoderm stratification in fossil spores.

ERDTMAN, GUNNAR. Palynological Laboratory, Stockholm-Solna. *Pollen Walls and Angiosperm Phylogeny.* By combining and improving upon the pollen investigation methods of J. Fritzsche (*Ueber den Pollen,* 1837), H. Fischer (*Beiträge zur vergleichenden Morphologie der Pollenkörner,* 1890), R. P. Wodehouse (*Pollen Grains,* 1935) and others, certain strides towards a better knowledge of pollen morphology have been made. In the 1870's, Eichler published *Blüthendiagramme,* a book often referred to in discussions of taxonomy and phylogeny. Attempts have been made during the past few decades to illustrate and describe the almost infinitely varying, more or less geometrical patterns of pollen and spore walls in higher plants by means of palynograms, with accompanying pollen diagnoses. By means of a number of palynograms (in the form of India ink drawings and photomicrographs), examples bearing on angiosperm phylogeny will be provided. The importance of thin-sectioning and the application of phase-contrast microscopy (including phase-contrast with ultraviolet light), elucidating fine topographical and stratigraphical sporoderm details, will be illustrated by lantern slides.

ERIKSSON, ERIK. University of Stockholm. *The Carbon Dioxide Reservoir.* Since the evolution of land plants, the carbon dioxide concentration in the atmosphere must have influenced the yearly assimilation of these plants as a growth factor, and possibly also the development of plant species, especially perennials constituting forest vegetation where carbon is stored for a considerable time before release. It is customary to picture the yearly carbon dioxide circulation in nature on a steady state basis. If nature is divided up into reservoirs such as living plants, humus, atmosphere and sea water, a steady state implies that the amount of carbon going into a reservoir equals the amount leaving it. This may not be necessarily so. The time lag between assimilation and decay in vegetation may cause oscillations in this circulation with periodic changes in the amounts of carbon in the different reservoirs. An external factor, such as the rate of overturning of sea water, can also cause fluctuations in the other reservoirs because of the steady downward flux of organic matter in sea water. Recently, another external factor, the combustion of fossil fuels, has been disturbing the original circulation. At present much work is consequently being devoted to studies on equilibrium conditions between oceanic and atmospheric carbon dioxide and on the rate at which equilibrium is approached.

ERWIN, DONALD C. University of California. *Crumple Leaf, a Virus-induced Disease of Cotton.* Virus from plants affected by the crumple leaf disease of cotton in California was readily transmissible by grafting but not by any of the common methods of sap inoculation, by dodder, or through the seed. Affected leaves of *Gossypium hirsutum* var. Acala 4-42 showed mosaic, puckering, and downward cupping. In contrast leaves of *G. barbadense* var. Sakel L or Sakel Domain were less severely puckered with the edges turned slightly upward. Several varieties of *G. herbaceum,* when inoculated, showed symptoms similar to Acala 4-42, but certain varieties of *G. arboreum* as well as *G. hirsutum* Marie Galante were either immune or highly resistant. Occasionally the virus was recovered from symptomless plants. In the field the virus severely reduced both the number of bolls and the yield of seed and lint when Acala 4-42 plants were inoculated early in the summer by grafting. The effect was similar when natural infection by means of the insect vector, *Bemisia tabaci,* occurred in mid-summer. Natural infection in late summer had little effect on yield or boll set.

Eslyn, W. E. *See* McNabb, Harold S., *et al.*

Eustigneev, V. B. Academy of Sciences, Moscow. *On the Mechanism of Photoreduction and Sensitizing Action of Chlorophyll.* Using spectral and electrometric investigation methods, the deuterium isotope method, and low temperatures, we have established that the photoreduction of chlorophyll and its analogues proceeds in two stages. At first, as a result of the primary photochemical transfer of an electron from the reducing agent to the light-activated pigment, a very labile and reactive primary reduced form which is active on an electrode is evolved that possesses the properties of a free radical-ionized semichinon. Given proper conditions, a proton can join this form and a more stable secondary reduced form will be generated. The absorption spectra of primary and secondary reduced forms differ from each other and from that of the original pigment. Direct experiments, using also all the above-mentioned methods, have demonstrated that the process of photosensitizing by chlorophyll and its analogues of redox reactions in solutions involves a stage of formation of the "electron" primary photoreduced form and its subsequent interaction with the electron (hydrogen) acceptor. Experiments with chlorophyll suspensions in water have shown the ability of chlorophyll to photosensitize redox reactions under heterogenous conditions. The measurements of photogalvanic effects of the chlorophyll film situated in a platinum electrode and submerged in an electrolyte solution have showed the photochemical electron exchange between the chlorophyll surface and the water medium. A hypothesis based on the results obtained is put forward concerning the mechanism of the sensitizing action of aggregated chlorophyll. Results of these investigations support the hypothesis of the natural chlorophyll chemical "reducing" participation in the primary photochemical act of photosynthesis.

Evdokimova, Tatiana. University of Moscow. *The Biological Circulation of Elements under Coniferous-mossy Forests.* The investigations were carried out in Karelia, in the sub-zone of the middle taiga. A wide occurrence of highly productive pine forests with luxuriantly developed moss-lichen cover is typical for the region studied. The primitive humus soils are formed under moss-lichen cover, on rocky mountains and mountain ridges, composed of dense crystalline schists. The development of the podzolisation process begins when the coniferous species are settled upon these soils. The gross analysis of mountain rocks, soil, and vegetation, showed that within the limits of one biocenosis, N, S, K, P, Ca, and specific for the Karelia, Mn and Ti, are involved most intensively in the biological cycle. An intensive accumulation of the micro-elements Sr, Zn, Pb, and others, is going on simultaneously. Very favourable forest-growth conditions are created, owing to an intensive biological accumulation of nutrient elements in the undeveloped primitive soils. The primitive Karelian soils possess a high reserve of nitrogen. Our investigations have shown that a very important role in the nitrogen balance of these soils is played by lichens, which are carriers of a specific group of oligonitrophile micro-organisms.

Evert, Ray F. Montana State College. *Ray Origin in Pyrus communis L.* The frequency with which new ray initials arise in the vascular cambium of *Pyrus communis* L. may differ considerably from one part of the cambium to another. New ray initials arise in the following ways: (1) through pseudo-transverse division near one end of a fusiform initial with the subsequent conversion of the shorter segment to ray initial(s); (2) through pseudo-transverse division near the center of a fusiform initial followed by reduction in length of one sister cell and its conversion to ray initial(s); (3) through anticlinal division which gives rise to a segment off one side of a fusiform initial followed by reduction in length of the segment and its conversion to ray initial(s); and (4) through reduction in length of a fusiform initial, without anticlinal division, followed by its conversion to ray initial(s). Increase in height of rays may result (1) from the loss of intervening fusiform initials, (2) through transverse (anticlinal) division of ray initials, (3) through vertical elongation (intrusion) of marginal ray initials, (4) through the union of newly formed ray initials with pre-existing ray initials, or (5) through a combination of these. Decrease in height of a ray may result from the loss of ray initials or from the division of a ray by a fusiform initial undergoing apical intrusive growth.

Evitt, William R. Jersey Production Research Co., Tulsa, Oklahoma. *Middle Silurian Vascular Plants from New York and Australia.* Palynological techniques applied to Middle Silurian marine sequences from New York and Australia have produced rich assortments of plant microfossils. Spores, isolated cells, and tissue fragments represent vascular plants with psilophytalean, pteridosperm, and conifer-like features. New York specimens are from a sequence with upper Llandovery graptolites. Australian samples are from *Baragwanathia-Monograptus uncinatus* beds in Victoria. The two sequences are approximately contemporaneous, containing several of the same distinctive species of hystrichosphaerids. Spore types range from simple *Punctatisporites* to *Triquitrites* and *Endosporites*. Plant tissues include: (*a*) primary xylem tracheids with spiral, annular and scalariform thickenings—generalised structures of undeterminable affinities; (*b*) contiguous annular tracheids – Psilophytales and possibly *Baragwanathia*; (*c*) tracheids with multiseriate bordered pits—Pteridospermae; (*d*) isolated and contiguous pitted tracheids and rays—?Coniferales. The conifer-like tissues are the most interesting of the plant remains. In all visible morphologic detail they are like corresponding cells from abietinean conifers. If they are not from conifers, then they represent a new Early Paleozoic group with coniferoid anatomy not only more advanced than the Pennsylvanian Voltziaceae, but directly comparable with Jurassic and later conifer woods of essentially modern aspect. The two florulas further document the antiquity of vascular plant stocks.

Ewan, Joseph. Tulane University, New Orleans. *Use of Complementary Data from Zoögeography in a Phytogeographic Study of the Rocky Mountains.* Plant geographers have paid scant attention to zoögeographic data although they may prove illuminating in the interpretation of existing floristic patterns, probable past and recent migrations of floras, centers of speciation, nature and intensity of endemism, and the source of the biotic agents effective in pollination and dispersal. Tundra grouse crossed Behringia and formerly occupied the Rocky Mountains far south of their present range, persisting today as relict colonies on outlying summits. *Menyanthes, Ranunculus, Primula, Oxytropis, Artemisia,* and other genera demonstrate a similar spreadway. The Sierra Madrean flora, dating from Miocene time, has its counterpart in such animals as the wood rat, *Neotoma mexicana,* which reached the mountains of Colorado. Canyon wrens, chats, and other austral birds range northward along the valley of the Snake River in company with the milkweed, *Asclepias fascicularis,* and a few other Lower Sonoran species of southern derivation. The *Polypodium vulgare* complex in western North America, *Ranunculus hebecarpus,* and other Euro-Pacific species complement the ranges of house finches and certain salamanders. Not only certain resident birds of the Columbia River basin but endemics among *Cardamine, Dasynotus,* and *Synthyris,* barely escaped extinction following the decimation of the presumed Miocene montane forest.

EYSTER, CLYDE. Charles F. Kettering Foundation, Yellow Springs, Ohio. *Mineral Requirements of Nostoc muscorum for Nitrogen Fixation.* Molybdenum, calcium, and boron were the elements found to be required by *Nostoc muscorum* especially for nitrogen fixation. The critical concentrations, which are defined as the minimum amounts for maximum growth, were determined to be 1×10^{-7} *M* for molybdenum, 0.75×10^{-5} *M* for calcium, and 0.9×10^{-5} *M* for boron. The critical concentrations of these elements for functions other than nitrogen fixation were found to be much less. For example, the critical concentration of molybdenum for the utilization of nitrate has been determined and was found to be 1×10^{-10} *M*. No molybdenum was required when ammonium ions furnished the nitrogen. The exact amounts of calcium and boron which are required by *Nostoc* for other functions are now being explored and should soon be known. To determine the critical concentration of molybdenum for nitrate utilization it was necessary to highly purify the reagents for the culture medium. This was done by an electrolytic method. Manganese, which is a key element in photosynthesis, has been found not to be required in any larger amount than is required by photosyntheses (1×10^{-7} *M*). While *Nostoc* required sodium at a critical concentration of 0.4×10^{-4} *M*, the role of sodium did not seem to have any direct connection with nitrogen fixation.

FAHN, A. The Hebrew University, Jerusalem. *The Anatomical Structure of Xanthorrhoeaceae Dumort. and Its Taxonomic Position.* The genera of the Australian family *Xanthorrhoeaceae* have been included in the *Juncaceae* or in the *Liliaceae.* Examination of the vascular elements, the amphivasal vascular bundles in the stems and/or rhizomes, the sclerenchymatous tissues and their arrangement in the leaves, the special palisade cells, etc., supports Dumortier's view as modified by Hutchinson, that the *Xanthorrhoeaceae* represents a distinct family within the Liliaceous stock. The characters of vascular elements correspond most closely to those established by Cheadle for the *Agavaceae.* On the basis of anatomical structure it is possible to arrange the genera of this family in 4 groups: (1) the *Kingia* group—vessel members in roots have scalariform perforation plates (*Kingia* R.Br., *Baxteria* R.Br.); (2) the *Dasypogon* group—the vascular bundles of the leaves are surrounded by a one-layered parenchymatous sheath (*Dasypogon* R.Br., *Calectasia* R.Br.); (3) the *Lomandra* group—the fascicular girders of sclerenchyma generally extend to the epidermis of the leaf, sclerified hypodermis does not occur in the leaves (*Lomandra* Labill., *Acanthocarpus* Lehm., *Chamaexeros* Benth.); (4) the *Xanthorrhoea* group—

vascular bundles are distributed as in monocotyledonous stems in the central pith-like tissue of the leaves, sclerified hypodermis occurs in leaves (*Xanthorrhoea* Smith). These groups do not agree with those established by Bentham and Hooker or by Engler.

FAHN, A. The Hebrew University, Jerusalem. *Annual Rhythm of Xylem Development in Trees and Shrubs in Israel.* The annual rhythm of xylem development has been investigated in 25 species of trees and shrubs growing in both the Mediterranean and the desert part of Israel. Based on this rhythm the following types can be distinguished: (1) growth rings indistinct, cambium active throughout the year (e.g., *Acacia tortilis* Hayne, *A. raddiana* Savi); (2) growth rings distinct, development commencing in spring, March-April (e.g., *Quercus calliprinos* Webb, *Pistacia lentiscus* L.); (3) growth rings more or less distinct, development commencing at the end of summer, August-September (e.g., *Tamarix aphylla* (L.) Karst); (4) growth rings more or less distinct, development commencing in winter, November-January (e.g., *Retama raetam* Webb, *Zygophyllum dumosum* Boiss.). In *Eucalyptus camadulensis* Dehnhardt and other tree species which have been introduced from Australia, growth-ring development was observed to commence at the end of summer (September) in Israel, that is, coincident with spring in Australia. It appears, therefore, that the annual rhythm of cambial activity in evergreen trees and shrubs can be regarded as a conservative character. Accordingly, it is suggested that the plants belonging to each of the above types are from different geographical areas. Type 4 seems to be the local type, as it is the best adapted to the climate of this region, which has a short rainy winter and a long dry summer.

FAIRBROTHERS, DAVID E., and MARION A. JOHNSON. Rutgers—the State University, New Jersey. *The Precipitin Reaction as an Indicator of Relationship in the Subfamily Festucoideae of the Family Poaceae (Gramineae).* In this research, proteins (antigens) from grass fruits are extracted and antibody production is elicited by the injection of the extracts into rabbits. The antisera produced by the rabbits are used to measure serological correspondence. Antisera to proteins of a species give intense reactions with proteins from closely related species but little or no reaction with those from distantly related species. Presently two measurements of the precipitin reaction are being employed. If the antisera titers are high, the photronreflectometer is used to measure turbidity, and if the titers are low, the ring test is used to measure the amount of precipitation. Strong to good precipitin reactions were obtained when antigens prepared from *Festuca rubra, Dactylis glomerata,* and *Lolium perenne* were reacted with antiserum against *Festuca rubra. Bromus inermis* gave a serological correspondence of lower magnitude and *Eragrostis curvula* gave a negative reaction. With two different antisera of *Dactylis glomerata, Festuca rubra* gave a close serological correspondence and *Bromus inermis* and *Poa pratense* showed less. *Festuca rubra, Dactylis glomerata,* and *Poa pratense* show strong serological correspondence with *Bromus inermis* antiserum. *Eragrostis curvula* and *Tridens flavus* have generally given negative results or relatively weak reactions with the above mentioned antisera. Six species of *Bromus* have been tested and it was found they can be distinguished serologically from each other. *B. rubens* and *B. carinatus* show greater serological correspondence with *B. inermis* than *B. catharticus, B. stamineus,* and *B. mollis.* The data have indicated that serodiagnosis can be employed as another discipline in aiding to establish a more natural system of classification.

Farkas, G. L., Z. Kiraly, and F. Solymosy. Research Institute for Plant Protection, Budapest. *The Biochemical Mechanism of Hypersensitive Reaction in Rust- and Virus-infected Plants.* In stem rust resistant wheat varieties responding to rust infection with hypersensitive lesion formation, infection results in a marked increase in polyphenoloxidase (PPO) activity, whereas susceptible varieties only respond slightly at very late stages of disease development with an enhanced PPO-activity of their tissues. The increase in PPO activity in resistant wheat tissues is correlated with a concomitant decrease in reducing substances (mainly ascorbic acid) apparently due to the utilization of ascorbic acid by the quinones produced. The ascorbic acid content of invaded susceptible tissues increases. A similar increase in PPO activity could be observed in all those investigated host-virus combinations which result in the development of local lesions in contrast to the unchanged PPO activity of plant tissues systemically invaded by given virus strains. Thus the development of local lesions is certainly correlated with an enhanced PPO activity and quinone formation. To prove this idea substances able to chemically reduce quinones were infiltrated into *Nicotiana glutinosa* leaves followed by infection with TMV. Lesion formation was totally inhibited by 10^{-2} M ascorbic acid and strong inhibitions were obtained with 5.10^{-3} M glutathion and 5.10^{-3} M cystein as well.

Farr, Wanda K., and M. T. Hilborn. University of Maine. *Cytochemical Studies in Aspergillus niger, NRRL no. 67.* Chitin and cellulose have been identified in the conidiophores, vesicles, sterigmata, and conidia of *Aspergillus niger*; chitin, but not cellulose, to date, has been found in the hyphae. Standard cytochemical methods for the identification of cellulose and of chitin have been supplemented by observations in polarized light and fluorescence analyses at successive stages of cellular development. Because of the similarity of unit-cell structure in cellulose and chitin, and their intimate association in the cell walls of this fungus, X-ray patterns have diffraction lines from both substances often superimposed in such a way as to render measurement difficult. The respective locations of cellulose and chitin in the cell walls help to explain the known resistance of this fungus to chemical reagents. Structurally, the walls of the spores and of the conidiophores have many points in common with those of higher plant cells. Their unique properties appear to depend largely upon the substitution of chitin for the pectic substances commonly present in the cell-wall matrix of higher plants.

Farrar, John L. University of Toronto. *The Diffusion Potential of Water in Plant Roots and Its Relation to Wilting.* A study was made of the movement of water in both directions between soil and roots. Each experimental plant was grown with its root system in two water-tight containers. Soil moisture changes were measured using Colman fiberglas units. The resistance which indicated the permanent wilting point (sunflowers) was determined for each unit. The plants were supplied with water by keeping the soil moist in one container. Changes in moisture content in the soil in the other container indicated the movement of water into or out of the corresponding part of the root system; it was called the test root. It was found that the test root absorbed water from the adjacent soil only when that soil was wetter than the permanent wilting point. Also, water moved out of the test root into the adjacent soil when that soil was drier than the permanent wilting point. It is suggested that an unwilted plant maintains the water in a certain tissue of the root system at a critical diffusion potential. Wilting can be meaningfully defined as the state of a plant when the diffusion potential of the water in that root tissue falls below the critical value.

FASBENDER, M. VERONICA, and JOHN D. DWYER. Mount Marty College and St. Louis University. *Pollen Studies in the Amherstieae, Cynometreae,* and *Sclerolobieae* (*Caesalpiniaceae*). A palynological investigation of 203 species of 61 genera of three Caesalpiniaceous tribes, the Amherstieae, Cynometreae, and Sclerolobieae, was carried out to ascertain somewhat more accurately tribal limits, generic relationships, and, in seven American genera, interspecific relations. Palynologically, *Sclerolobium, Tachigalia,* and *Crudia* are homogeneous. The heterogeneity of the pollen of *Dicymbe, Eperua, Brownea,* and *Peltogyne* suggests certain interspecific groupings. The pollen of the Cynometreae, the least specialized of the tribes, is small and differentiated into two types, a striate and psilate. The striate type offers supportive evidence for the close relationship of *Aphanocalyx, Gilletiodendron, Cryptosepalum, Scrorodophloeus, Talbotietta, Plagiosiphon, Monopetalanthus,* and *Cynometra* (some African species). The psilate type characterizes ten genera: *Copaifera, Gossweilerodendron, Hardwickia, Kingiodendron, Oxystigma, Prioria, Pterogyne, Guibourtia, Pseudocopaiva,* and *Cynometra* (some African and American species) and reaffirms the close affinity of these genera. The basic reticulate type of the Sclerolobieae is intermediate between the pollen of the other two tribes, both in sculpturing and size. This basic type marks *Sclerolobium, Vouacapoua, Melanoxylon, Recordoxylon, Batesia,* and, with some differentiation, *Phyllocarpus, Poeppigia,* and *Diptychandra.* The Amherstieae, being most highly evolved palynologically, are marked by a diverse assortment of shapes, sizes, and sexine patterns: reticulate, striate, verrucate, psilate, regulate, clavate baculate, retipilate, and ornate. The last three types are confined to *Eperua* which in pollen characters is the most exotic of all of the genera. Palynological evidence supports the retention of three distinct tribes based on the character originally used in defining the three tribes that is, the fusion or non-fusion of the ovary to the wall of the receptacle. Pollen characters suggest the transfer of certain genera from one tribe to another: *Dicymbe* (Sclerolobieae) to the Amherstieae, *Maniltoa* and *Neochevalierodendron* (Cynometreae) to the Amherstieae, and *Hylodendron* and *Tachigalia* (Amherstieae) to the Cynometreae and Sclerolobieae respectively. *Cenostigma* (Sclerolobieae) and *Stahla* (Cynometreae) are palynologically related to *Caesalpinia* (Eucaesalpiniaceae).

FAVARGER, C. Université de Neuchatel. *Vicariance entre races chromosomiques dans la flore alpine.* L'auteur examine quelques cas récemment découverts de vicariance entre races chromosomiques d'une même espèce linnéenne, dans la flore alpine. Ces cas ont ceci de remarquable que le Taxon le plus fortement polyploïde est toujours le plus oriental. Dans plusieurs cas, la limite entre les deux Taxa coïncide plus ou moins avec le domaine que Merxmüller (1952) considère comme marquant la zone frontière entre la province helvéto-norique et la province gallique (austro-occidentale). Il essaie d'interpréter ce phénomène. D'autre part, il examine, à la lumière de travaux récents et de comptages chromosomiques nouveaux le problème du pourcentage de polyploïdes dans la flore alpine, et dans les flores de haute montagne, en général.

FAWCETT, C. H., R. L. WAIN, and F. WIGHTMAN. Wye College, University of London. *An Examination of a Suggested Relationship between Chelating Properties and Plant Growth-regulating Activity.* The activity of forty chelators has been compared with 3-indolylacetic acid (IAA) and 2,4-dichlorophenoxyacetic acid (2,4-D) in the pea curvature, tomato epinasty, and wheat elongation tests. Many were completely inactive and a few possessed slight activity in wheat. The ultraviolet absorption spectra of 1-naphthoic and 1-naphthylacetic acids in the presence of cupric ions are similar and do not correlate with activity. By using synthetic copper compounds, it is shown that a chelation theory is not needed to interpret the spectra. From a study, using solutions of several closely related acids, comprising active and inactive growth regulators, it is shown that cupric ions lower the pH. The observed pH changes do not correlate with plant growth-regulating activity, and a chelation mechanism is not required to explain them. In the pH range studied two mechanisms are apparent. Mechanism I, which operates over the region of pH of physiological importance in plant cells, produces a large effect for all the compounds examined. The data show that hydrogen ion formation depends upon hydrolysis. Mechanism II appears limited to the pH region below about 5.4. The effect is smaller, different for the different structures examined, and zero for nitric acid. From all the evidence it is concluded that mechanism II depends upon complex formation. Aliphatic and aromatic carboxylic acids exhibit similar behaviour indicating that chelation involving the ring with copper (cu^{++}) does not occur.

FEINGOLD, D. S. *See* HASSID, W. Z., *et al.*

FELDMANN, JEAN. Faculté des Sciences, Paris. *A propos de la phylogénie des Floridées (Florideophycidae).* L'étude des caractères cytologiques (morphologie des plastes, en particulier) et biochimiques (constituants de la membrane cellulaire, produits du métabolisme) apporte peu de renseignements sur la phylogénie des Floridées. L'évolution de l'appareil végétatif aboutit souvent à des convergences entre groupes sans affinités étroites, ou montre, au contraire, la persistance d'un même type morphologique à des degrés très divers de l'évolution. La valeur phylogénétique des cycles de reproduction, d'interprétation discutée, est également très faible. Par contre, la structure et le développement des organes reproducteurs fournissent des caractères utilisables à condition d'envisager de près la structure de l'appareil femelle (présence ou absence de rameau carpogonial vrai, de gonophores carpogoniaux et auxiliaires) et d'interpréter les types réduits par surévolution. La réduction progressive de l'appareil végétatif du carposporophyte du fait de son parasitisme, et son mode de nutrition, aux dépens du gamétophyte par des cellules auxiliaires ou des cellules nourricières, apportent également des données phylogénétiques importantes. Toutefois, dans ce groupe des Floridées où nous manquons de documents paléontologiques et où l'évolution des caractères envisagés ne s'est pas effectuée parallèlement et au même rythme, il est difficile de reconstituer une phylogénie qui ne soit pas hypothétique et discutable.

FENSOM, DAVID J. Ridley College, St. Catharines, Ontario. *Transport Rate Changes in Excised Stems of Maple Induced by Applied Electromagnetic Forces:*

The "Flushing" Effect. When two-month-old green excised stems of *Acer saccharum* were subjected to applied direct current potentials of 0.1 to 0.5 volts, it was found that transpiration rates into the stem could be altered. Under certain conditions, after a period of exposure to light, the rate of flow suddenly increased in the stimulated stem by a factor of ten for a period of about five minutes before returning to normal. After one discharge it was not possible to activate the flow again before re-exposing the stem to light. This effect is discussed in relation to the electrokinetic theory of transport in plants.

Ferrari, R. A. *See* Benson, A. A., *et al.*

Ferwerda, J. D. Departement des Recherches H.C.B., Yaligimba-lez-Bumba, Congo Belge. *Growth, Production, and Leaf Composition of the African Oil Palm as Affected by Nutritional Deficiencies.* The results of 20 fertilizer experiments on oil palms, representing various soil types and climatic conditions in the Central Congo Basin, revealed that N-, P-, S-, K-, Mg-, Ca-, Cu-, and B-deficiency may have a depressing effect on growth and/or yield. These deficiencies were usually reflected in the P-, K-, Mg-, Ca-, and ash-contents of the leaves, but the N-content of the leaves was not affected by any of the treatments in our experiments. Seasonal fluctuations, which cannot be predicted, affect the absolute nutrient contents and their ratios, whether expressed as the ratio between two elements or as the fraction of the sum of the cations or anions in m.eq. The leaf composition of palms suffering from certain multiple deficiencies may be almost normal. It was found that low-P-contents may be due to P-, Mg-, Ca-, Cu-, B-, or Mo-deficiency, low K-contents to K-deficiency, low Mg-contents to P-, Mg-, Ca-, or B-deficiency, low Ca-contents to P-, S-, and Ca-deficiency, and low ash-contents to K-deficiency. High K-contents may indicate S- or Mg-deficiency, high Mg-contents K-deficiency, high Ca-contents K- or B-deficiency, and high ash-contents N- or Mg-deficiency. An interpretation of the leaf composition of individual samples without reference to the results obtained in fertilizer experiments, sited in the same region and sampled at the same time, may lead to erroneous conclusions.

Fetner, Robert H. Georgia Institute of Technology. *Distribution of Ozone-induced Chromosome Breakage in Vicia faba.* The frequency of ozone-induced chromosome aberrations was compared for those involving the SAT-chromosomes and the S-chromosomes; 250 kv. X-rays and methyl-bis-(beta chloroethyl)-amine hydrochloride were used for comparative analysis. It was found that ozone-induced breakage was less random than irradiation but more nearly random than breakage induced by the nitrogen mustard.

Flangas, A. L. *See* Allen, O. N., *et al.*

Flemion, Florence. Boyce Thompson Institute for Plant Research, Inc., New York. *Effect of Temperature, Light and Gibberellins on the Development of Peach Seedlings.* In seedlings from chilled seeds of peach (*Prunus persica* (L.) var. Stokes), normal stems and leaves were always produced by the daylight prevailing in the greenhouse at any time of the year, including the short days of winter, whereas these conditions were inadequate for the development of normal seedlings from unchilled seeds. The physiological dwarfs obtained from unchilled seeds were used in these studies since responses such as overcoming the lack of elongation of the internodes and the elimination of abnormal leaves could be readily observed. The chilling requirements of the seeds could, to some extent, be dispensed with by combining daylight with supplementary intermittent light at night. Although the stems appeared normal, some of the leaves were distorted and resembled the misshapen leaves of the physiological dwarfs grown under daylight conditions in the greenhouse. Exclusion of light from the tips of actively growing seedlings from either chilled or unchilled seeds produced extreme etiolation. Subsequently, when the apices were exposed to daylight, no further elongation occurred; however, whorls of leaves developed at the tips. This pattern of arrested development is characteristic of the physiologically dwarfed condition. Applications of gibberellin in lanolin produced very spindly stems and small leaves. Successive applications were required to prevent reversion to the telescoped internode condition of the dwarfs.

Fletcher, William Whigham. West of Scotland Agricultural College, Glasgow. *Tests with Gibberellic Acid on the Germination, Growth, and Nodulation of Trifolium repens.* Germination tests were carried out by sowing the seed between discs of filter paper moistened with gibberellic acid. The moistened discs were then slipped into plastic envelopes and placed in a cool incubator. Gibberellic acid was used at the following concentrations: 0.01, 0.1, 1.0, 10, 100, 500, and 1,000 parts per million. Examination of the seeds after five days incubation showed that there was no adverse effect on the percentage germination. Nodulation tests were carried out by growing white clover seedlings aseptically in nitrogen-free mineral salt agar (inoculated with rhizobia) to which was added gibberellic acid in the following concentrations: 25, 50, 100, 500, and 1,000 p.p.m. In all cases there was marked elongation of the petioles showing that the gibberellic acid was active. There was no reduction in the nodulation process. The effect of gibberellic acid on the growth of *Rhizobium trifolii* (strain 157) was tested at concentrations 0.01, 0.1, 1.0, 10, 100, and 1,000 p.p.m. by a turbidimetric method. There was no evidence of an adverse effect on the growth of the rhizobia at the concentrations used.

Flint, Franklin F. Randolph-Macon Woman's College, Lynchburg, Virginia. *Relationships of the Female Gametophyte and the Megasporangium.* The major types of female gametogenesis in the angiosperms have been described in detail by many investigators. Yet little evidence has been accumulated as to the reasons underlying the basic types or to support the causes of any particular type of development. Certain evidence will be presented which it is believed sheds light upon these problems. This evidence was accumulated from interpretation of fixed and stained sections only. Some other methods of investigation which may be used to accumulate further evidence will be discussed. In the Fritillaria type of female gametogenesis there are cytoplasmic radiations (fibrils) which can be traced from the developing megasporocyte through all stages to the mature gametophyte. The relationship of these structures to the type of female gametogenesis will be considered in some detail.

Flor, Harold H. North Dakota Agricultural College. *Complementary Gene Interaction in the Rusts.* Disease, caused by the rust fungi, is the result of the interaction of two organisms, the host plant and the parasitic fungus. A single phenomenon, pustule type, is the criterion both of the reaction of the host and of the pathogenicity of the parasite. Consequently, a determination of complementary gene interaction involves parallel studies of the inheritance of reaction in the host and of pathogenicity in the parasite. F_2 cultures of race hybrids of *Melampsora lini* segregated for pathogenicity on rust-resistant varieties of flax into simple Mendelian ratios. On varieties having one gene for resistance to the avirulent parent race, one gene conditioned pathogenicity; on varieties having two, three, or four genes for resistance to the avirulent parent race, respectively, two, three, or four genes conditioned pathogenicity. This suggested that for each gene conditioning resistance in the host there was a specific gene conditioning pathogenicity in the parasite. A new series of differential varieties, monogenic for resistance, was developed. These differentials make it possible to establish the pathogenicity genotype of rust cultures, and to interpret the roles of hybridization, mutation, asexual nuclear exchange, heterocaryosis, and parasexuality in pathogenic variability in terms of conventional genetics.

FLORSCHÜTZ, F. Velp, Hollande. *La Végétation tardiglaciaire aux Pyrénées Centrales françaises et en Espagne septentrionale: A, Pyrénées Centrales.* (*Voir* MENÉNDEZ AMOR, JOSEFA, *B, Espagne septentrionale.*) L'analyse pollinique d'une série d'échantillons, principalement consistant en "gyttja," recueillie d'un ancien lac près de Poueyferré aux environs de Lourdes, a produit un diagramme, daté en sept points au moyen du carbone radio-actif par le Professeur Hl. de Vries de Groningue. Les dates obtenues dénotent que ce lac existait déjà il y a ± 15.800 ans, vers le commencement du Tardiglaciaire. Le diagramme reflète l'histoire de la végétation environnante pendant la dernière partie du Pléniglaciaire le plus ancien Dryas, le Bølling, l'ancien Dryas, l'Allerød et le Dryas supérieur. Avant le Bølling le paysage avait le caractère d'une steppe, dans laquelle les arbres étaient très rares ou absents. Parmi les arbustes et les herbes, *Artemisia* occupait une place importante. Le commencement du Bølling s'annonce là, où la steppe fait place à un paysage de parc avec bouleaux dispersés. Dans la deuxième moitié du Bølling de légères forêts de *Betula* et de *Pinus* se développèrent, subissant une modeste régression durant l'ancien Dryas. Pendant l'Allerød, ces forêts devinrent plus denses. Pour la deuxième fois, au cours du Dryas supérieur, un paysage de parc, maintenant avec *Pinus* et *Betula*, apparut, remplacé au début de l'Holocène par des forêts à *Pinus-Betula-Quercus.*

FLORSCHÜTZ, F. *See* MENENDÉZ AMOR, JOSEFA

FLORY, WALTER S., JR. University of Virginia. *Chromosome Numbers and Phylogeny in Zephyranthes.* The genus is represented in two regions in America. Species of the northern region are those chiefly considered here. Somatic chromosome numbers in different species, by areas of occurrence, are (1) southeastern United States: Z. *atamasca*–24, Z. *treatae*–24, and Z. *simpsonii*–48; (2) West Indies: Z. *albiella*–18, Z. *puertoricensis*–25, Z. *insularum*–28, Z. *citrina*–48, Z. *grandiflora*–48, Z. *rosea*–48, and Z. *bifolia*–(60?); (3) southwestern United States: Z. *longifolia*–46-48, Z. *pulchella*–48 (and if *Cooperia* is included in *Zephyranthes*, C. *traubbii*–24, C. *drummondii*–48, C. *pedunculata*–48, C. *smallii*–54 and variants). Numbers for other northern area species: Z. *macrosiphon* (Mexico)–48, Z. *verecunda* (Mexico)–48 (24), Z. *nervosa* (Venezuela)–24.

For Z. *candida* from Argentina, $2n = 38$. The majority of the Mexican and southern South American species have not been studied cytologically. *Zephyranthez grandiflora,* Z. *rosa,* and probably Z. *atamasca* occur in Guatemala, as well as in areas indicated above, giving rise to problems of origin and distribution, or both. *Zephyranthes ajax* ($2n = 43$) has been back-crossed to both its parents (Z. *citrina* and Z. *candida*) giving rise to new clones with several intermediate numbers. Putative natural hybrids (*Cooperia smallii* and *C. jonesii*) between *Zephyranthes* and *Cooperia* are being investigated. Evidence from karyotypes, natural distributions, known or indicated hybridities, and phenotypes is taken into account in considering phylogeny of the genus. (Research supported by National Science Foundation Grant G2716.)

FOLLMANN, GERHARD. Institut für Virusserologie der Biologischen Bundesanstalt für Land- und Forstwirtschaft, Braunschweig, Germany. *Der Wasserhaushalt viruskranker Pflanzenzellen.* Der Wasseraustausch von Zellen aus der Epidermis von Stengeln und Blättern mit dem Ringfleckenvirus (Annulus tabaci Holmes) und dem Bukettvirus (*Solanumvirus deformans* Koehler) infizierter Tabaksorten (*Nicotiana tabacum* L.), an Kartoffelmosaik (*Marmor dubium* Holmes) und Strichelkrankheit (*Marmor upsilon* Holmes) erkrankter Kartoffelstauden (*Solanum tuberosum* L.), sowie mit Rübenmosaik (*Marmor betae* Holmes) infizierter Runkelrüben (*Beta vulgaris* L.) und Vogelmiere (Stellaria media Dill.) und an Weizenstreifenmosaik (*Marmor virgatum* Holmes var. *typicum* McKinney) erkrankter Maispflanzen (*Zea mays* L.) wurde plasmolytisch, kryoskopisch und schlierenoptisch untersucht: Gegenüber Kontrollpflanzen zeigten symptomtragende Pflanzenteile bei starken individuellen Schwankungen einen signifikanten Anstieg der Zellsaftkonzentration sowie der Wasseraufnahmerate. Im Initialstadium der Viruserkrankung sowie in älteren Pflanzenorganen wurden keine Unterschiede gefunden. Die Wasserdurchlässigkeit der Protoplasten gesunder Epidermiszellen konnte in stärkerem Ausmass als die viruskranker mit Atmungsgiften gehemmt werden. Daraus darf geschlossen werden, dass die in der gesunden Pflanzenzelle der aktiven Wasseraufnahme zufliessende Stoffwechselenergie nach Virusinfektionen anderen Stoffwechselzweigen dient, während der dem höheren Spiegel an osmotisch wirksamen Substanzen im Zellsaft entsprechende verstärkte Wasserbedarf durch gesteigerte passive Wasserpermeabilität gedeckt wird. Für die viruskranke Pflanze bedeutet das eine verstärkte Anfälligkeit gegen verschiedene ökologische Einflüsse, die sich unter anderem in schnellerem Welken manifestiert.

FOREMAN, FRED. *See* CLISBY, KATHRYN H., *et al.*

FORTI, GIORGIO. The Johns Hopkins University, Baltimore. *Photosynthetic Phosphorylation without Added Cofactors.* Photosynthetic phosphorylation by isolated chloroplasts requires, in order to proceed at high rates, the addition of either substrate amounts of a suitable electron acceptor or catalytic amounts of an electron transport cofactor. In the first case, stoichiometric amounts of oxygen are evolved; in the second case the cofactor mediates electron flow from the first reducing agent to the oxidant resulting from water photolysis. Such a cyclic process results in the regeneration of water. A number of cofactors are active in promoting the cyclic photophosphorylation; a non-physiological compound, pyocyanine, being the most efficient. In view of this lack of specificity, it is not possible to say which ones are active *in vivo.* Furthermore, all such cofactors represent exogenous additions at the present time. In order to observe the photosynthetic phosphorylation process uncomplicated by possible artifacts introduced with the addition of cofactors, we have studied the low rates of photophosphorylation observable without added cofactors. The present report will deal with the characteristics of the photophosphorylation in these conditions. The effect of inhibitors, the pH-activity relationship, and the effect of washing the chloroplasts have been studied.

FORWARD, D. F. *See* HOENIGER, J. F. M.

FOSBERG, F. RAYMOND. National Research Council, Washington, D.C. *Structural-functional Classification of Vegetation for Small-scale Mapping.* Most existing vegetation classifications are not based exclusively on vegetational features but involve aspects of the habitat, thus being classifications of ecosystems rather than strictly of vegetation types. For purposes of understanding such schemes are indispensable, but for purposes of mapping where patterns of vegetation are to be compared with patterns of other factors they are undesirable since they may lead to circular reasoning. A new scheme is presented, based strictly on structural and functional features of the vegetation itself, which may be suitable for most small-scale mapping purposes. Structure is here defined as the spatial arrangement of the components of the biomass of the vegetation. Function is used in the sense of those features of plants that are apparent adjustments or responses to environmental factors. These responses may be either genotypic or phenotypic. Primary divisions, called great structural groups, are based on degree of openness or consolidation, formation classes on habit and structure, formation groups on presence or absence of obvious seasonal dormancy, formations and subformations on dominant growth form, with emphasis on leaf texture, succulence, thorniness, graminoid habit, and other such features. The scheme may also be useful for simple comparative descriptive purposes, where subjective or interpretive features are to be avoided.

FOSBERG, F. RAYMOND. U.S. Geological Survey. *Vegetation and the Geologist.* Vegetation has usually been considered by the geologist mainly as an obstacle to field work, covering up the surface geology and making it hard to observe. Recently, however, vegetation has assumed a positive geological interest in two major respects, (1) as a geological agent, and (2) as an indicator or key to other phenomena of geological interest. These are briefly outlined:

Vegetation as a geological agent

1. Regulation of erosion and, consequently, of sedimentation
2. Regulation of CO_2 content of air and water
3. Regulation of infiltration of water into ground water body and consequently of spring and stream flow
4. Regulation of ground temperature
5. Baffle control of flood water
6. Accumulation of dune sand and river or estuarine silt; land building
7. Consumption of ground water
8. Protection of rocks from weathering
9. Acceleration of weathering of rocks

10. Formation and material of rocks
11. Soil formation
12. Accumulation of mineral substances in plant tissues and residues

Vegetation as an indicator of phenomena of geological interest

1. Recent vegetation
    - (*a*) Ground water
    - (*b*) Acidity, alkalinity, and salinity of soil and ground water
    - (*c*) Presence or absence of permafrost
    - (*d*) Limestone or other calcareous materials; serpentine; gypsum
    - (*e*) Selenium; uranium
    - (*f*) Glacial history
    - (*g*) Age of exposed surfaces
    - (*h*) Discontinuity of underlying materials
2. Fossil vegetation
    - (*a*) Age
    - (*b*) Climatic change
    - (*c*) Paleoecological conditions
    - (*d*) Stratigraphic correlation

FOSTER, ADRIANCE S. University of California. *The Phylogenetic Significance of Dichotomous Venation in Angiosperms.* The fossil record clearly suggests that, in the pteridosperms and ferns, the primitive venation was open dichotomous and that from this ancient pattern of vasculature reticulation progressively evolved. Among living ferns, the persistence of dichotomous venation in primitive families and the occurrence of transitions between dichotomous and net venation in the juvenile and adult leaves of certain genera are regarded as further evidence of the derived nature of reticulate vasculature. Both of these contrasted patterns of venation also occur in living gymnosperms. In *Ginkgo*, the cycads, and certain species of *Agathis* and *Podocarpus,* primitive dichotomous venation — with few or no anastomoses — has persisted while reticulate venation patterns are characteristic of the leaves of *Gnetum* and *Welwitschia.* Modern angiosperms, however, are characterized by highly diversified patterns of reticulate foliar venation and there is no paleobotanical evidence as to the origin or trends of specialization of such vasculature. But it is possible that, as is true of primitive types of vessels, stamens, and carpels, primitive venation patterns may still persist in some of the living angiosperms. On this basis, two questions are posed: (1) do any existing angiosperms possess open dichotomously-veined leaves and, (2) if so, what is the phylogenetic significance of such venation? An affirmative answer to the first question is provided by the occurrence of open dichotomous venation in two ranalian plants, *Kingdonia uniflora* (Ranunculaceae?) and *Circaeaster agrestis* (Ranunculaceae? Circaeasteraceae ?).

Kingdonia is an herbaceous perennial endemic to China and each of the five, lobed, cuniform segments of the pedately divided lamina is vascularized by a divergent system of more or less regularly dichotomizing veinlets. Although the majority of the veinlets terminate in the teeth of the distal margins of the segments, marginal and internal "blind" vein endings were observed in all specimens examined. Anastomoses are extremely rare and consist of the union of the inner branches produced from two adjacent dichotomizing veinlets. The node is unilacunar and the leaf trace consists of four major bundles which are arranged in pairs throughout most of their extension in the petiole. Near the point of attachment of the lamina segments, the two abaxial bundles dichotomize. Each of the *outer* strands resulting from these dichotomies unites with the adjacent adaxial bundles; the latter then diverge and dichotomize in the common bases of the paired lateral lamina segments. The two *inner* strands converge and unite, forming a single bundle which enters the base of the median segment; the dichotomy of this bundle is followed by the formation of two small inner branches which fuse to form the short pseudo-midvein of the median segment. This pseudo-midvein and the two lateral bundles represent the main "trunks" of three systems of dichotomizing veinlets extending through the median lamina segment.

Circaeaster is an annual, native to China and Tibet, and its small, simple obovate or spatulate lamina is likewise open dichotomously veined. Only two examples of anastomoses were encountered in a survey of many herbarium collections. The node is unilacunar and the petiole is vascularized by a bundle which dichotomizes below or near the base of the lamina.

Because of the present-day emphasis on the phylogenetic significance of woody numbers of the Ranales, it might be argued that the dichotomous venation of herbaceous types such as *Kingdonia* and *Circaeaster* is not "primitive" but rather is the result of phylogenetic "reduction." However, in the light of our knowledge of the morphology and ontogeny of angiospermic venation, it seems improbable to me that the open dichotomous venation of either of these genera has been "derived" from pinnate or palmate reticulate venation. On the contrary, I suggest that in *Kingdonia* and *Circaeaster*, the venation has remained at a relatively primitive level of evolutionary specialization and possibly may represent *one* of the types of foliar vasculature in ancient angiosperms. This suggestion is examined in the light of recent studies on the vasculature of the leaf in *Ginkgo* and certain woody ranalian genera.

FOSTER, H. H. Clemson College, South Carolina. *Identification and Pre-plant Control of Parasitic Nematodes Affecting Peach Trees in South Carolina.* Root-knot nematodes have been recognized as a major pest of South Carolina peach trees for many years. The following species have been tentatively identified: *Meloidogyne javanica, Meloidogyne incognita, Meloidogyne incognita* var. *acrita,* and *Meloidogyne arenaria.* The following genera of parasitic nematodes were frequently found associated with peach roots: *Pratylenchus, Xiphinema, Criconemoides, Trichodorus,* and *Tylenchorhynchus.* Pre-plant nematocidal treatment studies were begun at the Sandhill station in 1956. Root-knot infested soil was applied along each tree row site. Tree locations were randomized and single tree plots were replicated eight times. Nine different nematocidal treatments were used, each at two concentrations. Data for 1957 showed that increases in both shoot length and trunk circumference of trees on treated plots, in comparison with trees on untreated plots, were limited to three nematocides; 1, 2-dibromo-3-chloropropane, ethylene dibromide, and methyl bromide. In 1958, with the exception of VC-13, all nematocides used, at least at one rate, showed a significant increase for tree height, shoot length, and trunk circumference. Root-knot galling was significantly reduced by all nematocides during both years. The currently recommended dibromochloropropane, ethylene dibromide, and DD, plus five other nematocides, tended to prevent early stunting of trees normally caused by root-knot nematodes.

FOY, CHESTER L. University of California. *Distributional and Metabolic Fate of 2,2-dichloropropionic Acid (Dalapon) in Relation to Phytotoxicity.* Dalapon-2-C^{14} and Cl^{36}, as well as non-radioactive compounds, were employed in tracer and metabolic studies on cotton (a tolerant species), sorghum and corn (susceptible), and *Tradescantia.* Autoradiography and counting yielded both qualitative and quantitative data. Extraction, fractionation, and paper chromatographic procedures were developed or adapted for the detection of dalapon and metabolic degradation products. Ready absorption and translocation of dalapon through roots, leaves, and severed veins or petioles were abundantly confirmed; the rate and extent of entry and movement were shown by experiments to be influenced by several factors. Dalapon was absorbed, translocated, redistributed, and accumulated in higher plants (principally) as the original molecule or dissociable salt thereof. Furthermore, it remained essentially non-metabolized for long periods, especially in dormant or quiescent tissues. The stimulus in seeds persisted for three years in storage and was transmissible to the second and third generations. Some slow metabolic decomposition resulting in the release of Cl^{36} (from dalapon-Cl^{36}) or the incorporation of C^{14} (from dalapon-2-C^{14}) into other compounds occurred. Dalapon was metabolized by some species of micro-organism(s), producing five new labeled substances. Soil detoxification probably involves similar conversions. Experiments indicated that neither penetrability, translocatability, nor metabolic inactivation solely determines species specificity in the phytotoxic action of dalapon.

FRASER, D. A. Canada Department of Northern Affairs and National Resources. *Microclimates of a Tree.* The method wherewith the different microclimates of the same tree from root to crown are studied at Chalk River, Ontario, is demonstrated with a model of a light portable tower. Data recorded include those of soil moisture and soil temperature, internal tree temperature, and air temperatures at different levels. A portable scintillation counter developed in 1951 for autecological investigations with radioisotopes is compared to a new 1959 model utilizing transistors and a mercury battery.

FRASER, D. A. Canada Department of Northern Affairs & National Resources. *Transport of Mineral Nutrients in Trees.* Investigations during the past hundred years have indicated that the time of absorption, rates of movement, and redistribution of minerals in trees vary with the element studied as well as with the type and age of the plant tissue concerned. In the last decade the use of radioactive isotopes and tritiated water has helped to distinguish rates of movement of minerals from that of water. Development of special portable scintillation and geiger counters has facilitated the study of mineral translocation in mature trees. Radioautographic techniques have assisted in the determination of the tissue and cells responsible for the translocation and deposition of mineral nutrients.

FRASER, D. A., and H. T. DIRKS. Petawawa Forest Station, Chalk River, Ontario. *Internal Water Relations of Yellow Birch at Chalk River.* Wood moisture was measured in the butt of healthy and decadent yellow birch trees growing on various sites. The moisture content decreased from almost 100 per cent in May to about 60 per cent in late June when the leaves were fully unfolded. Wood moisture was usually 5 to 15 per cent higher in the butt of decadent trees as compared with healthy trees. It was higher in the trunk of trees on a dry site during a wet summer and on a wet site during a somewhat dry summer. Relative turgidity of leaves (the ratio of fresh weight of leaf discs to weight of the same discs at maximum turgidity) was measured at high and low levels of mature trees throughout three summers as well as in leaves of seedlings growing on soils with varied moisture contents. Relative turgidity was usually less during the day. During periods of drought it decreased even during the night. Exceptions observed may have been caused by leaf absorption of dew. In young birch seedlings relative turgidity values varied between 63 and 50 per cent in soils ranging from 100 to 70 per cent of field capacity. As the soil wilting point was approached, relative turgidity of leaves decreased to 33 per cent. After permanent wilting had occurred, the leaf discs lost their ability to regain full turgidity values when floated on water.

Fraser, D. A., and E. E. Gaertner. Canada Department of Northern Affairs and National Resources. *Concepts and Instrumentation for Micro-environmental Studies in Forest Research.* The interrelations among canopy, health status of individual trees, air and soil temperature, rainfall, and soil moisture on different soil sites at Chalk River, Ontario, over a ten-year period are discussed. Literature pertinent to this work and an evaluation of instrumentation applied to micro- and eco-environmental investigations are considered. The water cycle is investigated by comparison of potential evapotranspiration with soil moisture, water table levels, and run-off. The possible use of physiological techniques as an adjunct to micro-environmental measurements is outlined.

Fraser, D. A., and E. E. Gaertner. Canada Department of Northern Affairs and National Resources. *Use of Radioisotopes in Forestry Research.* In the ten years of investigations at the Petawawa Forest Experiment Station, Chalk River, Ontario, proximity of Atomic Energy of Canada Ltd. has facilitated the availability, handling, and analysis of radioactive elements. Potentialities of radioisotopes in forestry research have been explored directly in nutrition and translocation studies, and indirectly, by scrutiny of literature for information to be assessed for present and future use. The size of the tree under study influences the method applied and the quantity and specific activity of the isotope used. The adaptation of conventional counters for use in the field and for exact positioning on the tree is discussed. Activation analysis adds accuracy and expediency to studies concerned with elements, particularly if found in minute quantities. Radioisotopes have been used to explore relations between trees (root grafts) as well as between trees and their mycorrhiza. Absorption of labeled gases suggests both a technique for evaluation of foliar sprays and a check on aerial pollution, especially from chemical factories. The plant constituents can be followed after severance from the tree, and their part in the litter formation can be established.

Frederiksen, N. O., and G. O. W. Kremp. Pennsylvania State University. *The Spore Assemblage from the Pennington Coal.* A re-examination of spores from the Pennington coal of Rhea County, Tennessee, first described by W. Berry in 1937, has shown a rather unusual assemblage to be present. By far the dominant genus is *Lycospora*, with spores of *Cristatisporites*, *Schulzospora*, and

Anulatisporites or *Densosporites* also common; altogether, some 18 genera have been identified. The seam has been assumed to be uppermost Mississippian in age, but this is doubtful on the evidence of spores. Rare specimens of *Laevigatosporites* and occasional spores of *Florinites* and *Verrucosisporites* indicate that the coal might be Pennsylvanian. Of genera supposed to be restricted to the Mississippian and lowermost Pennsylvanian, only specimens possibly of *Convolutispora* have been found.

FRENCH, C. S., R. F. ELLIOTT, and J. S. BROWN. Carnegie Institution of Washington. *Various Forms of Chlorophyll a in Live Plants.* The absorption spectra of many plants, mainly unicellular algae, have been measured in the red region where the absorption is primarily due to chlorophyll. Measurements were made with a derivative spectrophotometer which gives increased accuracy in determining the shapes of the absorption bands. The chlorophyll *a* peak *in vivo* is composed of several different but overlapping components. The possible significance to photosynthesis of these different varieties of chlorophyll *a* will be discussed. Identification of the new chlorophyll *a* types present in various species can often be confirmed by fluorescence spectra of the same live plants.

FREY-WYSSLING, A. Federal Institute of Technology, Zurich. *Cytology of Heartwood Ray Cells.* The cytology of ray cells has been studied in material obtained by using an increment borer which permitted wood samples from the whole sapwood through the band of intermediate wood and deep into the heartwood to be tested. Living ray parenchyma are found in the sapwood, while the ray cells appear to have lost their protoplasm in the heartwood. The nucleus has an oblong shape in the outer sapwood, rounds off more and more in the transition zone, decays into two or three pieces and becomes pycnotic at the heartwood boundary. Starch grains, if present, persist throughout the whole sapwood and disappear only in the narrow intermediate zone. The same is true for the mitochondria whose reducing power can be clearly demonstrated in the sapwood near the cambial zone. Heartwood formation is intimately related to the cytological breakdown of the ray cells. (The European timbers investigated were: pine, larch, and yew with heartwood; spruce without heartwood; beech and ash with facultative heartwood.)

FREY-WYSSLING, A. Federal Institute of Technology, Zurich. *Submicroscopic Morphogenesis of Plastids.* The youngest stages of plastids found in the embryo sac (*Fritillaria*) or in leaf primordia (*Elodea*) are proplastids which cannot be easily distinguished from mitochondria. They do not contain the stainable body which was called "primary granum" by Strugger and "prolamellar body" by Hodge, McLean, and Mercer. Only if the proplastid evolves in the dark, that is, under conditions which obtain in buds, does such a body appear. In the light, stroma lamellae are formed. In darkened *Elodea* leaves the formation of lamellae in the young plastids is suppressed; instead, a prolamellar body appears. This is considered to be an accumulation of nucleoproteinic material which under the influence of light would have been used for the formation of lamellae. As soon as a proplastid with such a body is illuminated, its material is transformed into lamellae. The grana are formed by neoformation of additional lamellae. Leucoplasts are characterized by their lack of lamellae, while chloroplasts evolve from undifferentiated proplastids through lamellated young plastids to multilamellar bodies with piles of grana. The chromoplasts are found to represent degradation stages of chloroplasts with lipophanerosis or other signs of disintegration. The submicroscopic ontogeny of the plastids shows that leuco-, chloro-, and chromoplasts, after having reached their characteristic structures, have lost their mutual interchangeability as postulated by Schimper.

FRIEDMANN, I. The Hebrew University, Jerusalem. *Life History of Prasiola stipitata Suhr.* Thalli of *Prasiola stipitata* Suhr form either spores or gametes. Spore-forming thalli (diplosporophytes) are diploid ($2n = 12\text{-}14$) and produce in their apical part diploid aplanospores. Sexual thalli are composed of two parts. The lower is diploid and similar to the corresponding portion of the diplosporophyte. This produces, by meiotic divisions, haploid cells ($n = 6\text{-}7$) which are regarded as meiospores. Each meiocyte develops into a pair of corresponding male and female haploid gametophytes which remain attached to the mother thallus, arranged in a characteristic patchwork pattern. Sex determination is haplogenotypic. Anteriorly biflagellate anisogametes are formed. Before fertilization, the female gamete loses one flagellum. The male gamete attaches itself to the tip of the remaining female flagellum and slides down along it until both cells contact and subsequently fuse. The zygote is first pear-shaped and bears the female flagellum posteriorly, later it rounds off. Both zygotes and spores germinate into diploid thalli which are potentially capable of developing into either diplosporophytes or, if meioses set in, into sexual thalli. The onset of meioses is apparently controlled by external factors. In the intertidal belt where *Prasiola stipitata* forms a distinct zone, diplosporophytes and sexual thalli show a conspicuous zonation. The former grow at the highest and the latter at the lowest level of the *Prasiola* zone with a continuous gradient in between.

FRITTS, HAROLD C. Eastern Illinois University. *Studies of Tree Growth Using the Dendrographic and Multiple Regression Techniques.* Studies on *Acer saccharum* Marsh., *Quercus rubra* L., *Quercus alba* L., and *Fagus grandifolia* Ehrh. are presented in which daily radial growth is measured by means of the dendrograph and seasonal growth by means of annual growth rings. The data are related to appropriate environmental data and analyzed by multiple regression techniques. Both measurement and analysis techniques are illustrated and results from current studies are presented. These techniques make possible a highly refined analysis which sorts out the relative effects of temperature, evaporation, solar radiation, soil moisture, and time upon tree growth. Some ecological implications of recent results are suggested.

FRY, WAYNE L. University of California. *The Middle Oligocene Flora from Princeton, British Columbia.* Numerous Tertiary sedimentary basins are found in the southern half of the province of British Columbia. The sediments in nearly all of these contain fossil plants. The Princeton and Tulameen basins assume importance in that they have yielded a unique assemblage of organisms, including compressions and petrifactions of plants, fish, insects, fresh-water invertebrates, and rare mammalian remains. The ubiquitous occurrences of plants are locally varied by a single form appearing to the near exclusion of all others at certain localities. The flora consists of approximately ninety species. *Metasequoia, Cercidiphyllum, Azolla, Comptonia,* and *Equisetum* are the dominant genera. Coniferous and fern elements form an important element in the flora, but these components do not overshadow a wide array of angiosperm leaf species. Several of the latter are new records for the North American continent. On the basis of the plant evidence the age of the flora is considered to be Middle Oligocene. Floras to the north and east are of approximately the same age but do not contain the variety of species found at Princeton. The Florissant flora of Colorado is nearest to the Princeton in age, but it depicts a slightly cooler and drier aspect whereas the Princeton was probably warm, temperate and moist.

Fryxell, Paul A. U.S. Department of Agriculture. *The Evolutionary Position of Inbreeding Systems.* Sexual reproduction is the "normal" method of reproduction in the biological world. It has achieved this status as a result of its adaptive value in maintaining genetic variability. This adaptive value is at a maximum when sexual reproduction takes the form of an outbreeding system. Outbreeding mechanisms such as self-incompatibility serve as safety factors in maintaining such outbreeding systems. Evolutionary circumstances can cause plant species to "retreat" away from the outbreeding situation. They can do so by moving either toward apomixis or toward inbreeding. Darlington speaks of "apomixis: the escape"; inbreeding is quite comparable to apomixis as a means of escape. Inbreeding is sometimes viewed as a "blind alley," in the same way as apomixis. The thesis to be elaborated here is that it is a blind alley *only* where it is complete, that is, obligate, and that this is rare in nature. Facultative inbreeding (as facultative apomixis) can be a successful compromise since occasional outbreeding provides a continuing supply of variability. It can be successful in terms of long-term survival, not merely immediate survival. Data will be adduced in support of this thesis.

Fujino, Tsunesaburo. Osaka University, Japan. *Studies on Biological Characters of the Genus Candida.* By use of the micro-manipulator technique, it was found that the vitality of cells of *Candida albicans* could be determined by vital staining with triphenyl tetrazolium chloride. However, the vitality of trichomycin- or nystatin-treated cells could not be determined by this method. By the single cell culture method, it was found that the chlamydospore of *C. albicans* could produce germ tubes or buds, but no further development was observed. Nutritionally, *C. albicans, C. tropicalis, C. pulcherrima,* and *C. variabilis* were found to require only biotin; *C. rugosa* required thiamine and biotin; *C. pseudotropicalis* required biotin pantothenic acid and niacin; and *C. parakrusi* required biotin, pyridoxin, pantothenic acid, niacin, and thiamine. Proline or glutamic acid was found to have a biotin-sparing effect on the growth of *C. albicans.* Further, in medium containing glucose, β-alanine (or serine), and biotin, *C. albicans* showed a diauxie (Monod *et al.*, 1942) growth curve.

Fukuda, I. *See* Kurabayashi, M., *et al.*

Fuller, R. C. Brookhaven National Laboratory, New York. *Bacterial Photosynthesis Subsequent to the Photochemical Act.* The photosynthetic bacteria differ from higher plants in the structure of the photochemical apparatus as well as in the ability to evolve oxygen and the mechanism of carbon reduction. The chromatophore of the photosynthetic sulfur bacteria is a 300 Å diameter sphere composed of chlorophyll, carotenoids, protein, and phospholipid. Unlike the higher plant chloroplast which can make adenosine triphosphate (ATP) and fix and reduce CO_2, the bacterial chromatophore has no path of carbon enzymes. These organisms do not store starch, and concomitantly they do not metabolize CO_2 primarily to sugar. In *Chromatium* the primary pool of fixed carbon is in aspartic acid and gets there by a second fixation of CO_2 into the phosphoenolpyruvate carboxylase system. CO_2 and organic sources of carbon can only be utilized by *Chromatium* or *Chlorobium* in the light and anaerobically. The path of the utilization of reduced carbon in the light is via the glyoxylate shunt and the utilization of part of the citric acid cycle in the absence of oxygen. The diphosphopyridine nucleotide (DPNH) dependent malic dehydrogenase step is absent in *Chromatium* making a normal citric acid cycle impossible. A scheme for carbon metabolism in *Chromatium* will be presented. The results in *Chromatium* differ considerably from those in the green sulfur bacteria, *Chlorobium.* In the latter case there are no enzymes of the glyoxylate system present. The relationship of photosynthetic production of ATP by the chromatophores and carbon metabolism in the cell will be discussed. (Research carried out at Brookhaven National Laboratory under the auspices of the U.S. Atomic Energy Commission.)

FUNKHOUSER, JOHN W. Jersey Production Research Co., Tulsa, Oklahoma. *A Survey of Non-spore–Pollen Palynology.* As originally proposed, the word palynology embraced only the study of pollen and spores. The paleontologists have largely been responsible for extending its coverage to all organisms or parts of organisms that fall in the general spore-pollen size range. Many fossils of non-spore–pollen palynology are recovered along with spores and pollen, using the same extraction techniques. A large proportion of these are algal, including the coccolithophorids, dinoflagellates, diatoms, desmids, *Pediastrum*, and many of the hystrichosphaerids. There are also fungal elements, as well as fragments of larger plants, such as tissues and cells. In zoological palynology are microforaminifera, tintinnids, radiolaria, and the like. The rapidly expanding interest in these groups has been greatly stimulated by their proved or potential value in stratigraphic and environmental studies. This paper presents a survey of these non-spore–pollen groups and discusses what they are and their geologic ranges, ecologies, affinities, and methods of study.

FURCOLOW, MICHAEL L. U.S. Public Health Service. *Histoplasmosis.* Histoplasmosis is a fascinating disease from many points of view. First, it seems to be primarily a disease of nature, that is, the fungus grows in the soil and is transmitted to animals and humans by inhalation of the spores. Secondly, like many other fungus diseases, it was first considered to be of protozoal rather than fungal origin. Third, it has been the subject of much recent study and investigation and, indeed, is now considered to be the most prevalent systemic fungus disease in the United States. In 1945, 71 cases were collected from the total literature, whereas, in 1955, it was estimated that more than 30,000,000 people were infected in the United States alone. The clinical spectrum of the disease and its separation from tuberculosis, which it simulates, make a fascinating story in epidemiology and clinical medicine, which is still unfolding. Recent studies indicate that in both the United States and Canada as many as 3,000 persons may be in tuberculosis sanatoria misdiagnosed as having tuberculosis. Most have histoplasmosis only, although some have both diseases. Therapy at present is reasonably satisfactory and new tools are developing. A general review of the disease will be presented, illustrated by lantern slides.

FURMAN, THOMAS E. Escuela Agrícola Panamericana, Honduras. *Structural Connections between Epiphytes and Host Plants.* Repeated statement has established the concept that, while epiphytes may be segregated as to host plants, and may affect hosts unfavourably, substrate preference consists in chemistry of leaf exudates and bark, and the harmful effect on the host is essentially one of overgrowing and shading host leaves. Ruinen (Ann. Bogor. *1*: 101–157, 1953) in Java showed that, in many cases, organic connections exist between the roots of vascular epiphytes and host-plant tissues through fungal mycelia common to both. A study of vascular epiphytes in a Honduran cloud forest has examined interpenetration of root hairs or root mycelium with host tissues. Frequently, host-tree stems have very thin, lightly suberized bark, and consist of living tissues to their surfaces. Vascular epiphytes, chiefly orchids, bromeliads, and ferns, may penetrate living host stem-tissues with root hairs, or share a common fungus mycelium with them. Host-epiphyte connections are enumerated, their structural characters are described and illustrated, and possible nutritional implications are mentioned.

FURUYA, M., and A. W. GALSTON. Yale University. *Effect of Pre-incubation with Manganous Ion or with 2,4-dichlorophenol on the Subsequent Activity of the 3-indoleacetic Acid (IAA) Oxidase of Peas.* The IAA oxidase activity of peas is known to be enhanced by the addition of manganese and 2,4-dichlorophenol (DCP) as cofactors and inhibited by exposure of the etiolated plant to red light prior to harvest. The effect of red light is due to the production in the plant of a dialyzable inhibitor. We have now found that the red light induced inhibition of IAA destruction *in vitro* may be reversed by pre-incubation of the crude plumule extract with manganous ion. The longer the period of pre-incubation, the shorter is the lag in IAA destruction, until finally the original uninhibited activity is regained. In contrast, pre-incubation with DCP markedly increases the red light induced inhibition. When DCP and manganese are both present in the pre-incubation mixture, the inhibition due to DCP is manifested at first but is later overcome by the manganous ion effect. Pre-incubation of crude plumule extracts from dark-grown peas with DCP also results in inhibition of subsequent IAA destruction. The inhibition experimentally induced by red light exposure or pre-incubation with DCP cannot be reversed by further addition of DCP, but can be reversed by subsequent incubation with manganous ion.

FYFE, JAMES L. Plant Breeding Institute, Cambridge, England. *Evaluation of Inbred Lines of Tetraploid Lucerne.* In an attempt to apply the "hybrid corn" method of breeding to lucerne, it is desirable to identify, at an early stage, superior parental inbreds and to predict the performance of double crosses. An experiment comparing all possible crosses between six slightly inbred lines showed that most of the variability between progeny means, for yield and other attributes, can be accounted for in terms of general combining ability and experimental error. Contributions by specific combining ability are small and usually statistically insignificant. Tests of general combining ability should, therefore, be adequate to identify superior inbreds. With tetrasomic inheritance, a cross between unrelated parents has one-third the inbreeding coefficient (F) of the parents. Forage yields of lucerne show a linear relation with F. In arguing from the general level of yield of a group of single crosses to that of the corresponding double crosses, this relation allows a simple adjustment for the reduction in F. An experiment now in progress should show how the general combining abilities of parents, expressed in single crosses, are reflected in the performance of double crosses.

FYFE, VIVIANE C. University of Cambridge. *Comparative Study of the Genetics of Tristyly.* In collaboration with Professor Sir Ronald Fisher, the inheritance of style-length has been found to differ in the species so far studied, namely, *Lythrum salicaria, Oxalis articulata,* and *Oxalis valdiviensis.* The common features controlling style length are: (1) the existence of two loci, S and M, (2) the short-styled form is epistatic to mid and long, and (3) the long-styled form is recessive at the M locus. *Oxalis valdiviensis* has disomic inheritance. The short is dominant and linked to mid. There are two mid, one long, and three short genotypes. *Oxalis articulata* also has disomic inheritance. Short is recessive and independent of mid. There are four mid, two long, and three short genotypes. *Lythrum salicaria* is tetrasomic. The short is dominant and independent. There are four mids, one long, and ten short genotypes. Linkage of style-length and petal-colour genes exists in *O. articulata* and *L. salicaria.* The consequences of linkage in tetrasomics are briefly shown.

GAARDER, K. RINGDAL. *See* BRAARUD, T.

GAERTNER, E. E. *See* FRASER, D. A.

GALIANO, E. F. Universidad de Madrid. *Notas fitosociologicas sobre el este de Canadá.* Se describen algunas comunidades vegetales del este de Canadá, en las provincias maritimas. Se estudian asociaciones sobre las dunas costeras, terrenos arenosos y bordes de rios; y tambien en las orillas de lagos del interior de la provincia de Quebec. Se hacen algunos comentarios acerca de la sucesion de esta vegetacion. Se realiza un estudio mas detallado sobre las asociaciones que pertenecen a las Clases *Litorelletea* y *Ammophiletea,* y de esta ultima se hace un estudio comparativo con Europa.

GALINAT, WALTON C. Harvard University. *Evolution of a Glume-rachis Relationship in the Andropogoneae and Maydeae.* The cupulate fruit-case which protects the caryopses in the wild American *Maydeae* is the product of trends toward increased compression, condensation, and resulting reductions. Branch reduction in panicles (*Erianthus*) produces spikes (*Elyonurus*). Reduction to sterile pedecellate spikelets and shorter glumes concentrates energy and growth into a thicker rachis (*Manisuris*). Compression of the young spikelets against this thickened rachis embeds them within cavities, the openings of which are covered by specialized outer glumes. Further reduction to sessile, solitary, and unisexual spikelets is associated with increased lignification in the hollowed rachis segment and its glume covering (*Tripsacum and Euchlaena*). Although the caryopses of modern maize are protected in mass by husks rather than individually by long glumes or cupulate fruit-cases, these husks prevent natural dissemination. But the variation in maize includes the tunicate gene (*Tu*) which produces long glumes, slender rachises, and "tassel-seed" which may disseminate naturally. When this gene is introduced into *Euchlaena,* the glume-rachis structure becomes similar to *Elyonurus.* This pleiotropic effect on the glume-rachis relationship suggests that a gene something like *Tu* has been involved in the evolution of the American *Maydeae.* The evolution and development of these floral structures result from modification of the phytomer, a repetitious pattern of organs.

GALLEGLY, M. E., and L. J. ALEXANDER. West Virginia Agricultural Experiment Station and Ohio Agricultural Experiment Station. *Fundamental Aspects of Disease Resistance in Tomato to Phytophthora, Fusarium, and Tobacco Mosaic Virus.* Monogenic and multigenic resistance occurs in tomato to *Phytophthora infestans* and *Fusarium oxysporium f. lycopersici.* Dominant genes TR_1 and *I* confer resistance to race *O* and race *1* of the two pathogens, respectively. The *I* locus is in linkage group V. There are physiologic races of these pathogens which will attack dominant-gene resistant plants. The number of genes involved in multigenic resistance to the two diseases remains undetermined. Resistance in tomato to TMV has been reported as due to a single dominant gene, two dominant genes, and/or three recessive genes. There are strains of TMV capable of producing symptoms on plants with reported types of resistance. Plants with gene TR_1 react rapidly to infection by tomato race *O* of *P. infestans* by producing necrotic spots presumably infiltrated with toxic phenols. The *I*-gene resistance is bound closely with metabolism throughout the host. Infected wilt-resistant plants are higher in phenols than healthy resistant plants, whereas the phenolic contents of infected and healthy susceptible plants remain the same. Resistance to TMV involves prevention of symptom expression and reduction or prevention of infection. New races of these pathogens may arise by mutation. Sexual recombination occurs in *P. infestans.*

GALSTON, A. W., and RAVINDER KAUR. Yale University. *Studies on the Intracellular Localization of Carboxyl-labeled 2,4-D in Etiolated Pea Sections.* Carboxyl-labeled 2,4-dichlorophenoxyacetic acid (2,4-D) was supplied to etiolated pea epicotyl sections in a sucrose-buffer medium. The sections were then permitted to grow for 20 hours, during which time they increased in length 70-80 per cent and in fresh weight by 100 per cent. The tissue was then ground in a glass homogenizer in 0.5 *M* sucrose + .001 *M* ethylenediaminetetraacetic acid (EDTA), and the resulting homogenate fractionated by centrifugation to yield, successively, cell-wall materials, "mitochondria," and "microsomes." All precipitates and their supernatant fractions were counted for C^{14} content. In all instances, the supernatant contained the great bulk of the activity, the usual ratio (supernatant : precipitate) being in excess of 10:1. The small activities in the precipitates could be further reduced by washing. Addition of an equal volume of 1 *M* trichloroacetic acid (TCA) to an aliquot of the final supernatant in an attempt to precipitate the proteins resulted in a loss of activity in all fractions. This was shown to be due to a TCA-induced decarboxylation of the 2,4-D. Fractionation of the supernatant with ammonium sulfate, on the other hand, resulted in the deposition of some precipitates with activity.

GALSTON, A. W. *See* ASOMANING, E. J. A.; FURUYA, M.; MCCUNE, D. C.

GAMS, HELMUT. Botanical Institution of Innsbruck. *Systematic Relations among Primitive Mosses.* Since Hedwig, astomous or cleistocarpous and gymnostomous mosses have been generally placed before the stegocarps with peristomium. As most cleistocarpous and gymnostomous mosses are known as polyphyletic and derived from Arthrodonts, a similar position is now accorded by most authors only to *Archidium* and *Sphagnum*. The Tetraphidales (Elasmodonts of Mitten) and Nematodonts (Polytrichaceae, Dawsoniaceae, Buxbaumiales) are certainly older than the Arthrodonts. *Schistostega* is most probably derived from Tetraphidaceae, *Archidium* from Dicranales. The placing of *Sphagnum* before *Andreaea* seems not sufficiently justified and the supposition by S. Lindberg, C. Müller, and Limpricht of a relationship between *Sphagnum* and Leucobryaceae (especially *Ochrobryum*) merits serious consideration.

Garber, E. D. University of Chicago. *Biochemical Mutants of Toxigenic, Bacterial Phytopathogens.* Certain phytopathogenic species of *Pseudomonas* produce an exotoxin, detectable as a bacteria-free, chlorotic halo surrounding the necrotic focus of infection in the leaf at the site of inoculation. Nutritionally deficient mutants of a number of these species were produced by a standard procedure involving ultraviolet light irradiation and screening with penicillin. Each species produced a high frequency, 85 to 95 per cent, of mutants with a specific type of nutritional deficiency. In each species, however, the deficiency or deficiencies were different. For example, *Ps. tabaci* yielded mostly methionine-requiring mutants; *Ps. tomato* gave mostly mutants requiring aromatic amino acids or nicotinic acid; and *Ps. phaseolicola* produced mutants needing glutamic acid, aspartic acid, or proline. The exotoxin of *Ps. tabaci* has been identified as a methionine anti-metabolite; the biosynthesis of this amino acid in *Ps. tabaci* appears to differ from that reported in other microbial species. These observations suggested that the exotoxin may be a consequence or by-product of methionine biosynthesis in this species. It is possible that each species produces a different exotoxin and that each exotoxin is a consequence or by-product of an "unusual" biosynthetic pathway. It is also possible that the frequently occurring mutants with a specific nutritional requirement may provide the clue to the identification of the type of exotoxin or anti-metabolite being produced in each species.

Garber, E. D. University of Chicago. *Nutritional Aspects of the Host-Parasite Relationship.* The role of nutrition in the host-parasite relationship is related to the nutritional requirements of the parasite as they may or may not be satisfied by the host environment. The parasite must get all of its nutritional requirements from the host at the site either of inoculation or of localization. Consequently, it becomes necessary to correlate the host as a growth medium with the nutritional requirements of the pathogen. Mutants with specific nutritional requirements have been used to investigate the nutritional aspects of the host-parasite relationship. Three different mechanisms have been proposed to interpret the avirulence of certain nutritionally deficient mutants for specific hosts: (1) the host provides an inadequate concentration of a nutrilite required by the pathogen at the site of inoculation; (2) the host provides an adequate concentration of the required nutrilite, but other compounds may inhibit the uptake of the nutrilite; and (3) the host provides an adequate concentration of the required nutrilite, but other compounds may be needed to facilitate the uptake of the nutrilite. Specific examples will be presented and discussed to illustrate each mechanism.

Garcia, Enriqueta, C. Soto, and F. Miranda. Instituto de Geografía de la Universidad Nacional de México. *Larrea and Climate.* The distribution of *Larrea tridentata* in Mexico coincides with certain climatic characteristics. Following Köppen's climatic classification, it covers the zones designated as "BW" and also part of those with "BS" climate in which the ratio, annual precipitation/mean annual temperature, is smaller than 22.9, and the winter precipitation less than 10.2 per cent of the annual. Its southern boundary seems to be in areas where the annual range of temperature is less than 7° C. Part of its northern boundary in the United States coincides closely with the 5° C. January isotherm. The related *Larrea divaricata* from South America shows an outstanding symmetry with *Larrea tridentata*; it has the same climatic boundaries except in its eastern limits where it penetrates slightly into the "C" sub-humid climates. The long distance migration proposed by Axelrod to explain the distribution of *Larrea* does not seem a plausible hypothesis. The present-day distribution of more macrothermic xeric plants such as *Castela* and *Cercidium* suggests a greater continuity between the dry zones in the past. The bi-zonal distribution of *Larrea* and its climatic adjustment could also indicate that temperatures in the tropical zone were lower in past epochs, facilitating its transtropic spread.

Garrison, Rhoda. *See* Wetmore, R. H.

Gaussen, Henri Marcel. Faculté des Sciences, Toulouse. *Classification naturelle des spermaphytes.* Faire une classification naturelle implique un appui sur la phylogénie et des idées sur les processus de l'évolution. L'évolution n'a pas la même rapidité pour les divers caractères et les caractères sexuels ont une évolution lente. L'évolution progressive dans son ensemble, sauf pour les parasites, paraît procéder par pseudocycles successifs. Chaque groupe commence par des types à pièces nombreuses, peu spécialisées. L'évolution, dans le cycle, réduit le nombre de pièces, les soude ou les spécialise jusqu'à un type "évolué" très simplifié. On assiste alors à la soudure de plusieurs types évolués pour donner un type "surévolué" qui ressemble à un retour ancestral. Ce type sert de départ à un nouveau cycle. Le fait que ces pseudocycles ne se succèdent pas avec la même rapidité pour les divers caractères rend très difficile l'étude des filiations. Les caractères sexuels evoluant lentement sont probablement les plus utiles à étudier pour avoir une classification correcte. Chez les spermaphytes on peut considérer cinq megaphylums: (1) Ptéridospermales, Cycadales (Caytoniales) Monocotylédones et herbacées dicotylédones; (2) Ptéridospermales, Bennettitales, Pentoxylales et ligneuses dicotylédones; (3) Coniférophytes; (4) Gnetophytes; (5) Casuarinales dérivant des Articulées du Primaire.

Gaussen, Henri Marcel. Faculté des Sciences, Toulouse. *Sur les races géographiques des gymnospermes en Europe.* Les aires des gymnospermes actuelles sont les résidus des aires disloquées par les périodes glaciaires. Il faut distinguer les espèces qui paraissent résiduelles de celles qui paraissent à leur place. (1) *Conifères:* G. *Pinus* — résiduelles: *peuce, laricio, silvestris, uncinata, pumilio, nughus;* G. *Abies* — résiduelles: *pinsapo, pectinata, nebrodensis, cephalonica, borisii-regis, sibirica;* G. *Picea* — résiduelles: *Omorica;* à sa place: *excelsa;* G. *Larix* — à leur place: *europaea, polonica.* (2) *Taxacées* — à sa place: *Taxus.* (3) *Gnetophytes: Ephedra.* Pour chaque espèce, les races géographiques sont énumérées et localisées.

GEHRIG, R. F. *See* KNIGHT, S. G., *et al.*

GÉNÉREUX, HENRY. *See* DUNCAN, J.

GEORG, LUCILLE K. U.S. Public Health Service. *Physiology of Dermatophytes.* The unique parasitism of epidermal tissues of man and animals by dermatophytes has led to the study of their physiology and chemical make-up. The development of alkalinity in media is related to the powerful proteolytic ability of these fungi. Oxidative deamination has been described and several proteolytic enzymes have been isolated. Of especial interest is keratinase from *Microsporum gypseum,* and the ability of this fungus to digest collagen, feathers, hoof, wool, horn, hair, and silk. The carbohydrate-splitting activities of these fungi are less dramatic; however amylase, maltase, and sucrase activity and the pathways of carbohydrate dissimmulation have been demonstrated. Specific requirements for vitamins and amino acids have been discovered in a number of species. They appear to be stable characteristics, and nutritional tests have been developed for the identification of a number of species. Studies of the chemical composition of dermatophytes are also of interest. The cell walls have been shown to consist entirely of chitin, and at least nine amino acids have been found in the protoplasm of a number of species. Cytochemical studies have given further information concerning the composition of these organisms, and indicate the specific locations of nuclear and other substances.

GEORG, LUCILLE K. *See* MCDONOUGH, E. S., *et al.*

GERASSIMOVA-NAVASHINA, HELEN. Academy of Sciences, Leningrad. *The Cytology of Fertilization in Flowering Plants.* The peculiar features characteristic of fertilization in flowering plants help in understanding the morphological nature of the process in question, especially when cellular level of inquiry is reached. Double fertilization is possible only owing to a highly specific organization of the embryo sac. It allows the twin sperms to utilize mitotic activeness which they preserve in the course of their development, which results in mutual repulsion (of the sort existing between any pair of co-produced sister nuclei) for their delivery to the female cells. The male sex elements are thus characterized by their remaining in a state of suspended mitosis (prolonged telophase); they complete their mitotic cycle and enter resting stage under the influence of the resting female cells, the latter going out of rest owing to the influence of the male fertilizing system. This conflict of states of the male and female elements should be regarded as the motive force of the fertilization process, leading to the development of a new individual. Cytological study thus reveals that the act of fertilization is, as a matter of fact, a process of continued development. The variety of forms of sexual fusion falls into the following two basic types: the premitotic type (which corresponds to the "Sea-urchin type" in animals) where the sperms immediately upon contact enter the female nuclei and pass resting stage within; and the postmitotic type (corresponding to the "Ascaris type" in animals) which is characterized by the sperms falling into rest side-by-side with the female nuclei while sexual union takes place in this case only in the course of the first cleavage of the zygote. There exist also transitions between the two types, which depend on the mode of the development of the sperms and on the surroundings found by them within the embryo sac.

GERASSIMOVA-NAVASHINA, HELEN. *See* NAVASHIN, MICHAEL S.

GESSEL, STANLEY P. *See* WALKER, RICHARD B.

GIBBS, R. DARNLEY. McGill University. *Comparative Chemistry of Plants as Applied to Problems of Systematics: An Introduction to the Symposium.* It is assumed that related plants have similar chemistry, and that relations may be revealed by studies of plant chemistry. Parallel evolution has occurred in the chemistry as in the other characters of plants. The danger of relying on but one chemical character is stressed. Early contributions to this subject are briefly mentioned. Extensive and intensive studies of plant chemistry will be illustrated by the author's work on higher plants, with special reference to lignins, the HCL/methanol reaction, raphides, cyanogenetic glycosides, the "juglone" test, etc. These approaches are also illustrated by the work of the other contributors to this symposium, to which brief reference will be made as an introduction to their papers.

GIFFORD, ERNEST M., JR. University of California. *Histology of Vegetative and Strobilate Apices in Certain Gymnosperms.* Cytohistological zonation in vegetative shoot apices of gymnosperms is well known and a rather large volume of pertinent literature is available at the present time. Unanimity of opinion does not exist, however, in reference to sites of greatest mitotic activity and correlative growth relations of the shoot apex. Despite the accumulation of information on vegetative shoot apices, scarcely any investigations have been concerned with structure of strobilate apices. To this end a study was undertaken to investigate vegetative and strobilate apices of several gymnosperms: *Pinus ponderosa, P. sylvestris, P. albicaulis, P. murryana; Larix decidua; Ginkgo biloba.* The vegetative and strobilate apices of investigated plants have comparable zonation patterns throughout active growth periods. The spatial relations of the zones may vary between the two categories of shoots, but the basic organization is present invariably. Only near the end of active strobilate development does the essentially vegetative zonal pattern become obscured. The results of this study indicate that there may be fewer structural differences between vegetative and strobilate apices in gymnosperms than between vegetative and floral apices in angiosperms. A consideration of the phylogenetic origin of each shoot type is of utmost importance in these comparative studies.

GILBERT, MARGARET L. Florida Southern College. *A Species Ordination of the Upland Forest Herbs of Southern Wisconsin.* With the aid of electronic calculators, Cole's index of interspecific association and the X^2 test of significance of the index were calculated for 185 species of shrubs and herbs in 69 upland forest stands of southern Wisconsin. Significant negative indices were used to develop a species ordination. Similar patterns were obtained by applying other ordination methods to the data. The species ordination can be used to frame studies of the interaction between species and environment, and to indicate problems for detailed autecological studies.

GILES, MARGARET C. *See* SMITH, BEN W.

GILLESPIE, BARBARA, and WINSLOW R. BRIGGS. Stanford University. *Lateral Movement of Auxin during Geotropic Response of Corn Coleoptiles.* The experiments of Dolk in 1930 suggest that unilateral gravitational stimulation of the corn coleoptile results in a lateral transport of auxin, followed by differential growth of the two sides. Dolk's results fail to convince many modern workers, who have concluded on the basis of experiments involving radioactive indoleacetic acid that lateral auxin transport does not occur. The technique of Dolk has now been refined in a way that unambiguously demonstrates that the geotropic response is mediated by auxin or a precursor moving across the coleoptile. *Avena* test diffusions from upright corn coleoptile tips, from horizontal tips partially bisected in a longitudinal plane to within 2 mm. of the apex, and from totally bisected horizontal tips have been assayed. The lower halves of the partially split coleoptile tips release a much larger amount of auxin than do the upper halves. From the lower and upper halves of the totally split tips equal auxin quantities are obtained. The total amount of auxin recovered from a horizontal tip is equal to that recovered from a vertical tip. Sources of error encountered by other investigators will be discussed.

GILLESPIE, WM. H., and AUREAL T. CROSS. West Virginia University and Pan American Petroleum Corporation. *Upper Pennsylvanian Pittsburgh Coal Flora, Fairfax Knob, West Virginia–Maryland.* The roof-shales above the Pittsburgh coal (Monongahela = Upper Pennsylvanian) in open-pit mines in the vicinity of the historically famous Fairfax Stone marker, West Virginia–Maryland border, contain a flora of about 40 species in 25 genera. These plants are remarkably well preserved, especially in the massive reddish, ironstone concretionary layers and smaller nodules in the roof-shale. The smaller of these plant-bearing concretions are almost identical in appearance to those of the somewhat older, famous Mazon Creek, Illinois, concretions. The 14 genera based on leaf remains are dominated by *Alethopteris virginians, A. sullivantii, Neuropteris scheuchzeri, N. heterophylla, Pecopteris miltoni,* and *P. unita.* Other species of these genera and *Callipteridium, Odontopteris, Lescuropteris* (?), *Mariopteris, Cyclopteris, Mixoneura, Annularia, Asterophyllites, Sphenophyllum,* and *Cordaites* are also present. Fertile structures include abundant *Dolerotheca campanuli,* fertile fronds of *Asterotheca, Ptychocarpus,* and *Danaeites,* cones of *Bowmanites, Calamostachys,* and *Cingularia* (?), and at least three seed types and one cupule. Especially interesting features are the association of *Alethopteris* with *Dolerotheca* (which contain *Monoletes* spores), polymorphism shown by *Neuropteris* and *Odontopteris,* intergradation of several species (?) of *Alethopteris,* the identity of the seed-like cupules, and the abundance of both fertile and sterile *Danaeites* fronds.

GIRAUD, G. *See* MOYSE, A., *et al.*

GLOUSHCHENKO, I. E., and O. V. TOVMASJAN. Academy of Sciences, Moscow. *The Mentoring Action of the Foreign Pollen in Self-pollinating Corn Lines.* Lately, many experimenters of the Soviet Union have studied the action of foreign pollen during the fertilization process. This question is not only of theoretical interest, but is also directly connected with plant breeding practice. It was shown that foreign pollen can have a very different mentoring influence on the fertilization process and on the obtained progeny. The present paper deals with the problem of the pollen influence of a distant species on self-pollinated corn lines and their progeny. We have used in the experiment lines obtained from two early varieties: Bezenchuk No. 41 and Belojaroe psheno. As is known, self-pollination during several generations leads, as a rule, to depression of quantitative and qualitative indices (plant height, vegetative period, yield, etc.). We have studied the action of hemp and sunflower pollen on self-pollinated (inzucht) corn lines with the purpose of annihilating the depression. The foreign pollen was used together with the plant's own pollen in the ratio: one part of the plant's pollen to two parts of the foreign pollen (that of hemp and sunflower). The experiments have shown that in all instances when the plants (in the presence of their own panicle pollen) are, in addition, pollinated with other species pollen, the percentage of the seed set is much higher, and the progeny has good vitality and productivity. As a result of pollination with pollen of their own plants mixed with the pollen of another species, the grain number of the mentoring corn cobs is higher than it would be after ordinary self-pollination: in the variety Bezenchuk No. 41 it is 66 to 82 per cent higher and in the variety Belojaroe psheno it is 12 to 64 per cent higher. The height of the plants of the first variety lines is 23 to 29 per cent higher and that of the second variety lines is 6 to 28 per cent higher. The green mass weight of the experimental plants is twice that of the self-pollinated lines. The cob length of the mentoring corn lines of the variety Bezenchuk No. 41 is 28 to 50 per cent more and in the same kind of lines of the variety Belojaroe psheno it is 4 to 66 per cent more than that of the ordinary self-pollination. The distant species pollen, finding itself in the corn stigma, helps to activate the fertilization process, provokes heterogeneity of the sex elements which restores the fertilization ability. In the subsequent generations, the high vitality of the self-pollinated lines is retained even when the lines do not receive foreign pollen for a second time.

GLYNNE, MARY D. Rothamsted Experimental Station, Harpenden, England. *Effects of Previous Crops on Eyespot, Take-all, and Yields of Winter Wheat.* When wheat is grown in consecutive years on the same land, eyespot (*Cercosporella herpotrichoides*), take-all (*Ophiobolus graminis*), and weeds increase, and the number of ears and yields of grain decrease. Weather, soil type, and other factors determine the rate at which these two soil-borne diseases increase. On the heavy arable land at Rothamsted they often reach a maximum in the third wheat crop which yields rather less than half as much as the first. Yields of subsequent wheat crops fluctuate at this low level for many years if nutrients are adequate and weeds checked. One year free from the susceptible crops of wheat and barley reduces both diseases, but in some years eyespot is severe enough in the subsequent wheat crop to cause serious loss. Two years free from wheat and barley generally suffice to reduce both diseases to a low level and to give yields as high as in the first wheat crop.

GOHEEN, A. C. *See* COOK, JAMES A.

GOLDSMITH, MARY HELEN M. Harvard University. *Studies on the Polarity of Auxin Transport in Avena Coleoptiles.* When physiological amounts of 3-indoleacetic acid (IAA) are applied to sections from coleoptiles, the present experiments show (by following the bioactivity and radioactivity of C^{14}-carboxyl IAA) that the major part of the uptake at the apical end of a section is a metabolic process which is reduced about 85 per cent in nitrogen. The remaining uptake of IAA at the apex which occurs in nitrogen and subsequent distribution of radioactivity in the section can be accounted for by diffusion. When IAA is applied to the base of the sections, however, uptake is essentially the same in air or nitrogen, and equivalent to apical uptake in nitrogen. The amount of C^{14}-IAA entering the base is the same whether the apex-to-base transport is saturated with unlabeled IAA, or labeled IAA, or is completely devoid of IAA (no IAA supplied at the apex). Several different situations could explain the polarity of auxin movement. For example, auxin might enter the base as rapidly as the apex but be immediately re-exported by a polar system of transport; or alternatively, auxin simply might not enter the basal end of a cell but remain in intercellular spaces. These experiments suggest that the polarity of auxin transport may be due to metabolically dependent uptake which occurs only at the apical end of each cell.

GOOD, H. M. Queen's University, Kingston, Ontario. *Fungi Associated with Fomes igniarius in Decay of Poplar.* To determine the numbers, and the possible significance, of fungi associated with *Fomes igniarius* in decay of poplar, a considerable group of isolations was made from twenty-five poplar trees which showed decay typical of *F. igniarius.* At least 115, and as many as 950, isolations were made from each pocket of decay. A total of 66 fungi was isolated. Neither the type of agar used (malt, malt oxgall, Difco yeast nitrogen base, potato-dextrose, soil-extract, wood-extract) nor storage at –18° C. for periods of up to ten months appreciably affected the range of fungi obtained. A number of fungi (5 to 27) occurred in each pocket of decay. None appeared to be sharply limited to a particular stage of decay or region of the tree. Of the ten smallest pockets studied, only one yielded *F. igniarius* though the specificity of the symptoms and the failure to isolate other known decay organisms left little doubt that *F. igniarius* had caused the decay and had died out, presumably as a result of competition. Parallel studies of wounds and branch stubs of poplar suggest that a number of fungi may precede *F. igniarius* in colonizing the trunk. No studies of synergistic or antagonistic effects among the fungi have yet been made.

GOOD, H. M. *See* NAQVI, S. H. ZAMIN

GOODWIN, RICHARD H. Connecticut College. *The Cellular Pattern of Growth in Phleum Roots as Revealed by Photomicrographic Records.* Methods are described for obtaining photomicrographic records of continuous files of epidermal cells on a growing root. Data have been obtained from an analysis of the photographic records which establish the pattern of growth and root hair differentiation in the epidermis of roots of *Phleum pratense* L. under standard controlled conditions. The effects of applications of coumarin, scopoletin, and indole-acetic acid on this pattern are presented. Each of these compounds has a distinctive effect upon the rate and nature of cell enlargement and the rate of cell division.

GORCHAKOVSKY, P. Academy of Sciences, Sverdlovsk. *The Endemic and Relic Elements in the Flora of the Urals and Their Origin.* The proportion of endemic elements in the Ural flora is not high, not a single endemic playing a leading role in the formation of plant communities. Most endemics are gradually dying out, only a few endemics being young species. The high-mountain endemics are classified into four principal groups: (1) endemics which have originated as a result of ecological and morphological differentiation and the disruption of the areas of the plain-inhabiting ancestral species (concurrent with the alpine orogenesis) and consequent development of a series of vicarious species in separate mountain regions; (2) endemics which have originated as a result of transformation under the local conditions of high-mountain species which had immigrated from the other mountain regions in the Pleistocene; (3) endemics which have developed from plain-inhabiting species through adaptation to high-mountain conditions; (4) endemics of hybrid origin. Some of the mountain-steppe and rock-inhabiting endemics have obvious European bonds, while others have Asiatic bonds; a number of endemics are genetically allied to a series of kindred species inhabiting the mountains of Crimea, the Caucasus, and Asia. The relic elements are classified into five groups: (*a*) relics of the pre-glacial broad-leaved forests; (*b*) glacial relics inhabiting bare riverside rocks; (*c*) mountain-steppe and rock-inhabiting relics of Asiatic mountain origin; (*d*) Pleistocene high-mountain relics of Asiatic mountain origin; (*e*) Pleistocene relics of Siberian origin, characteristic mainly of the larch forests.

GORHAM, EVILLE. University of Toronto. *Chlorophyll Derivatives in Soils.* The proportion of chlorophyll derivatives in humus is much smaller in terrestrial than in aquatic soils. In the former the proportion declines with increasing fertility, while in the latter it rises. Differences in absorption spectra of acetone extracts may reflect the balance between the amounts of organic matter originating inside and outside lake basins, while stratigraphic examination of chlorophyll derivatives may be of significance in studies of lake evolution.

GORHAM, P. R., B. SIMPSON, C. T. BISHOP, and E. F. L. J. ANET. National Research Council of Canada. *Toxic Waterblooms of Blue-green Algae.* Unialgal cultures of several strains of planktonic blue-green algae, including those most suspected of causing animal death, have been grown and found to vary greatly in toxicity. At least two toxic factors have been recognized. One produces fast deaths at low dosages and is algal in origin. The other produces slow deaths at much higher dosages and is bacterial in origin. The fast-death factor (FDF) is an endotoxin that so far has been encountered only with strains of *Microcystis aeruginosa* Kütz. emend. Elenkin. Its production is genetically and physiologically controlled. An FDF-producing strain of *M. aeruginosa* has been mass-cultured and the cells shown to be toxic when administered orally to sheep, calves, and smaller animals. FDF isolated from these cells has been identified as a quite stable cyclic polypeptide having an intraperitoneal LD_{50} for white mice of 0.45 mg./kg. body wt. Another toxin, which is bacterial in origin, has been identified as nitrite. Its contribution to the toxicity of waterblooms is uncertain. It is concluded that a complex of interdependent variables determines the degree and kind of toxicity that a waterbloom can develop.

GORHAM, PAUL R. *See* CLAUSS, H., *et al.*; NELSON, C. D., *et al.*

GORLENKO, M. V. Moscow University. *Biochemical Method for Determination of Parasitism in Hyphomycetes Fungi Imperfecti.* There are a number of genera in Hyphomycetes, comprising parasitic as well as saprophytic species, and it is often difficult to discern their specific morphological features. The same relates to some probably mixed (e.g., *Alternaria tenuis*). We propose, therefore, to distinguish the degree of parasitism in certain Hyphomycetes conformable to their capacity of accumulating amino nitrogen in the culture medium, owing to the dissociation of peptone therein. For this purpose, fungi are incubated for 15 days in a liquid medium, containing 1 per cent peptone, 0.1 per cent KH_2PO_4, 0.1 per cent $MgSO_4$, 2 per cent dextrose. An inverted dependence is found to exist between the quantity of the amino nitrogen, accumulated in the culture medium, and the parasitic activity of the fungus. Furthermore, these relations are characteristic of each of the investigated genera. Fungi of the genus *Cladosporium* accumulate 2.45 mg. of amino nitrogen per 1 gm. of dry substance, its saprophytes, 8.7 mg.; parasites of the genus *Alternaria*, 4.15-5.77 gm., its saprophytes, 16.1-29.4 mg.; *Stemphylium* parasites, 1.5-7 mg., its saprophytes, 11.9-18.8 mg.; *Helminthosporium* parasites, 8-9, its saprophytes, –11.6-13.6 mg. A proper arrangement of fermenting apparatus well adapted to the use of amino acids, formed in plant tissues, after the decomposition of plant protein by parasites, seems to account for a great consumption of amino nitrogen by parasitic species. The study of both *Alternaria tenuis* and *Stemphylium ilicis* strains, isolated from a different substrate, showed that those from seeds and killed seedlings are nearer to parasites by their character of accumulating amino nitrogen in the culture medium than strains from soil and paper, isolated by the same method. These can be referred to saprophytes. Thus we suggest a method to show the degree of parasitism of both species and the strains of one species.

GORSKI, FRANÇOIS. Krakow, Pologne. *Une simple méthode pour mesurer l'exigence quantique de la photosynthèse.* Le principe de la méthode consiste à déterminer l'intensité de photosynthèse de deux suspensions d'algues (*Chlorella*) en fonction de l'intensité lumineuse, pour des intensités lumineuses faibles, l'épaisseur de la seconde suspension étant le double de la première. Si l'on représente sur un graphique les résultats des mesures on obtient deux droites dont les coefficients angulaires sont m_1 et m_2 ($m_2 > m_1$). Dans ces conditions on peut démontrer que l'exigence quantique R_q est donnée par la formule $R_q = f\ \lambda\ (2m_1 - m_2/m^2{}_1)$, dans laquelle λ est la longueur d'onde de la lumière et f un facteur dont la valeur dépend uniquement du choix des unités employées pour mesurer l'intensité lumineuse (ergs ou calories) et l'intensité de photosynthèse (μg. ou μl. de CO_2 ou O_2).

GOULD, FRANK W. A. & M. College of Texas. *Polyploidy in Grasses of Southwestern United States.* Chromosome numbers have been reported for 200 grasses native to the southwestern United States and 202 native to the southeastern. The grasses of the Southwest are 75 per cent polyploid while those of the Southeast are 60 per cent polyploid. The difference between these series appears directly ascribable to the large number of diploid Panicums in the latter region. Here 41 out of 58 Panicums with recorded chromosome numbers are diploid, as contrasted with 7 out of 12 in the Southwest. From a list of 305 native Texas grasses for which chromosome numbers have been reported, 100 were selected as being "widespread and abundant" in one or more vegetational regions. These grasses were 75 per cent polyploid, exactly the same ratio as in the 200 Southwestern grasses. Based on reported chromosome counts, the percentage of taxa with polyploid genotypes in the major genera of Texas grasses is as follows (numbers of species in parenthesis): *Eragrostis* (10) 100 per cent; *Setaria* (7) 100 per cent; *Poa* (7) 100 per cent; *Sporobolus* (12) 92 per

cent; *Stipa* (9) 89 per cent; *Chloris* (7) 86 per cent; *Paspalum* (19) 84 per cent; *Muhlenbergia* (15) 73 per cent; *Tridens* (7) 71 per cent; *Bromus* (7) 71 per cent; *Andropogon* (21) 62 per cent; *Bouteloua* (13) 54 per cent; *Aristida* (8) 37 per cent; *Panicum* (64) 36 per cent.

GOWING, DONALD P., and ROBERT W. LEEPER. Pineapple Research Institute of Hawaii. *Chemical Structure of Hydrazine Derivatives in Relation to Induction of Flowering in the Pineapple.* Following the observation that beta-hydroxyethylhydrazine could induce flowering in the pineapple (Science *122*:1267), about fifty other hydrazine derivatives were tested. Six additional compounds were found active. Neither the free hydroxyethyl grouping nor the free hydrazine grouping was common to the active compounds although all contained the C–C–N–N system. It was concluded that activity was a specific characteristic of certain compounds, rather than a general property of the group.

GRAMBAST, LOUIS. Faculté des Sciences, Paris. *Les Charophytes fossiles: caractères morphologiques et principes de la systématique.* Les grands progrès qui, dans une période récente, ont été réalisés dans l'étude des Charophytes fossiles, concernent essentiellement les formes du Paléozoïque et du Mésozoïque, lesquelles sont, pour la plupart, caractérisées par une fructification dont la structure s'écarte très sensiblement de celle des *Characeae.* Ces dernières, apparues dès le Carbonifère, mais très faiblement représentées jusqu'au Crétacé moyen, prennent une extension considérable à l'Eogène. Le nombre des espèces est alors très important, leur variabilité est grande, la famille est à son apogée. Pourtant l'architecture des espèces actuelles étant réalisée, ces multiples formes présentent toutes, quant à la fructification, la même structure fondamentale. Aussi a-t-on pu penser qu'en l'absence de l'appareil végétatif, il était impossible de classer ces fossiles. Toutefois, étudiant, comparativement aux espèces actuelles, des matériaux tertiaires très abondants, nous avons pu voir que des coupures s'imposaient. Les groupes que l'on reconnaît peuvent être définis par un ensemble de caractères fins de la gyrogonite dont la signification et l'importance relative ont été examinées, afin de tenter d'introduire, pour ces *Characeae* anciennes, une systématique naturelle.

GRANT, V. *The Diversity of Pollination Systems in the Polemoniaceae.* A survey will be given of the modes of pollination within a natural plant family. The various pollination systems will be related to the broad phylogenetic relationships. The diversification of related plants with respect to their method of pollination is seen as a process of adaptive radiation. The pattern described for the Polemoniaceae is characteristic of many other angiospermous families.

GRANT, W. F. *See* CALLEN, E. O., *et al.*

GRANT, WILLIAM F. Macdonald College of McGill University. *Polyploidy and Interspecific Hybridization in Amaranthus.* Spontaneous triploid hybrids ($2n = 49$) were discovered between *Amaranthus spinosus* L. ($2n = 34$), a diploid species, and *A. dubius* Mart. ($2n = 64$) which was found to be a tetraploid. Meiosis in the hybrids was irregular and 15 univalents were most frequently found along with the apparently allosyndetic bivalents (15 I's + 17 II's = $2n$ = 49) at metaphase I. Univalents were excluded from the telophase nuclei in both meiotic divisions resulting in supernumerary microspores and in a reduction in the mean size of the microspores. Consequently, the triploids were largely sterile and the few undersized seeds produced failed to germinate. Seed weight, seed volume, stomatal size, and pollen-grain size were proportional to chromosome number in the parents only. Since *A. dubius* exhibits typical bivalent behavior in synapsis, it is considered to be an allotetraploid in which *A. spinosus* has been one progenitor. It is suggested that the diploid *A. quitensis* ($2n = 32$) might be the other progenitor, but from chromosome number relations and morphological considerations more than two species may be involved. As a result of the high sterility of the triploids, gene exchange between the parental species must be of a very limited nature.

GRASSL, CARL O. U.S. Department of Agriculture. *Introgression between Saccharum and Miscanthus in New Guinea and the Pacific Area.* Cultivated and semi-wild plants in the Pacific Area known under the names of *Erianthus maximus* Brongn. and *Saccharum pedicellare* Trin. are considered to have originated from hybridization between *Saccharum* and *Miscanthus*. Characteristics believed to have been derived from *Miscanthus* are known to be present in some of the native chewing canes (*Saccharum officinarum* L.), particularly in many of those originally found in Hawaii. In the highlands of New Guinea somewhat similar but much more complex and variable plants were found to be common in native gardens and as widespread escapes from cultivation. In New Guinea and possibly to some extent in Fiji, *Saccharum robustum* is considered to be the main species of *Saccharum* involved in the production of the complex hybrids in question, while in the Pacific area, particularly the Society Islands and New Caledonia, *S. officinarum* is also or exclusively involved. *Miscanthus floridulus* (Labill.) Warb., a common arrow plant in native gardens and widespread as a weed in the highlands of New Guinea, is considered to be the *Miscanthus* species involved in this area. A new generic name is proposed for the bigeneric hybrids.

GRAY, JANE. University of Arizona. *Microfloras from the Miocene of the Columbia Plateau, Oregon.* Middle-Upper Miocene, lacustrine-fluviatile, diatomaceous ash, near contact with the underlying Columbia River basalt at three localities in eastern Oregon, contains pollen, spores, and other plant microfossils, referred to some 34 families and 41 genera. The following are among genera recognized: *Abies, Cedrus, Picea, Pinus, Tsuga, Acer, Alangium, Alnus, Betula, Carya, Celtis, Cercidiphyllum, Fagus, Fraxinus, Ilex, Juglans, Liquidambar, Nyssa, Oenothera, Pachysandra, Platanus, Pterocarya, Quercus, Tilia, Ulmus/Zelkova, Vaccinium*?. Undifferentiated pollen of the Taxodiaceae-Cupressaceae-Taxaceae is also present. Gymnosperms compose 34 to 65 per cent of the microfossils, with "taxodiaceous" exines best represented. Other coniferous pollen, while less common, occurs most abundantly at Blue Mountains confirming other evidence that this site of deposition was at higher elevations than the others. All but a small percentage (about 2.5 per cent) of the remaining pollen is that of woody dicotyledons. The microfloras show close floristic relationship with megafloras from the same localities although they have many more genera in common than do the megafloras. With few exceptions, the dominant megafossils are well represented by pollen. Both records indicate that the late Miocene vegetation of eastern Oregon was composed predominantly of deciduous trees and shrubs presently living in summer-wet, middle latitude forests of eastern America and Asia.

GRAY, NETTA E. Agnes Scott College, Decatur, Georgia. *A Report on the Morphology and Anatomy of an Unusual Parasitic Gymnosperm from New Caledonia.* *Podocarpus ustus* Brongn. & Gris is a shrub, the sole species in section *Microcarpus* of the gymnosperm genus *Podocarpus* which is widely distributed in the Southern Hemisphere. *Microcarpus* is distinguished by having both scale-like leaves and woody receptacles for the female strobili. Discovered nearly a century ago, this species is now known to be parasitic upon the stem of *Dacrydium taxoides* and possibly other gymnosperms. The vegetative scale leaves are adpressed against the stem with over half their length adnate to it. Stomata are scattered in the abaxial epidermis and on young stems. They are neither in longitudinal rows nor always longitudinally oriented. The noteworthy characteristic of these leaves is the lack of mesophyll differentiation. There is no supporting tissue other than the xylem tracheids of the vascular bundles, and no palisade parenchyma. This homogeneous mesophyll has no conspicuous air spaces. These characters accord well with the parasitic habit. The pair of scale leaves immediately below the female strobilus are decussate and free from the stem. The next several leaves are arranged spirally, free, and of increasing length; the terminal one bearing the single ovule. Fewer stomata are present on these leaves; some may occur in the epidermis of the ovule.

GRAYSON, JOHN F., and PIERCE, RICHARD L. Magnolia Petroleum Co., Dallas, Texas. *Floristic Interpretations from Cretaceous Polospores of Central Texas.* Floristic changes occurring within the major plant taxa during Cretaceous time in the geographical area of central Texas are summarized. The apparent succession of the flora is described. Each major taxon is broken down into its respective polospore types and the changes occurring within each are discussed. Special emphasis is placed upon the origin and diversification of the angiosperms and the evolutionary implications. Frequency distribution studies of polospores indicate the flora during Early Cretaceous time was predominantly non-angiospermous. During Late Cretaceous time, the morphological types referable to the angiosperms rapidly increased in both number and quantity, although some elements of the earlier flora continue to be represented. The morphology of some of the more important Cretaceous polospore taxa is illustrated and discussed. Points of apparent origin and extinction of these polospore taxa and their degree of success and constancy of occurrence are noted. Climatic implications based upon the data available are considered. Comparisons are made with polospore taxa described in the literature, principally from Europe and Russia. The floristic implications from our investigations are contrasted with those obtained from European and Russian Cretaceous sediments.

GREEN, PAUL B. University of Pennsylvania. *Structural Changes in Growing Cell Walls.* Plant growth is the result of cell division and subsequent cell enlargement. In the latter process the cell wall is of great importance with regard to both the extent and the direction of growth. The rate of increase of cell volume is a function of turgor pressure and primary wall strength; the final shape of the cell is a function of the interaction between the anisotropic wall structure and turgor pressure. The electron microscope permits detailed knowledge of the arrangement of fibrillar wall constituents and refined optical methods provide quantitative data on wall fine structure. This paper will attempt to summarize advances in the knowledge of primary wall fine structure and to relate them to parallel advances in cell wall chemistry and physiology. In brief, most cell walls appear to grow through the deposition of cellulose microfibrils at or near the inner surface, the deposition being made with the fibrils running generally in the transverse direction, as hoops on a barrel. The physiological basis for deposition in this direction is under investigation, as is the re-orientation of fibrils after deposition.

Green, P. S., and J. Keenan. Royal Botanic Garden, Edinburgh. *Cultivars of Wild Origin.* The application of the International Code of Nomenclature for Cultivated Plants is clear for plants which have no wild counterpart. The application of the International Code of Botanical Nomenclature is clear where the botanical naming of wild material is concerned. Problems arise, and will continue to arise, when it comes to the naming of certain cultivated plants of known wild origin. These problems are occasioned by: (1) the introduction of plants of cultural significance insufficiently differentiated for recognition at a botanical rank; (2) the reduction to complete botanical synonymy through revisional work or an increase in knowledge of the polymorphism of a species, such that plants well known under Latin epithets in cultivation no longer merit botanical rank. The value of Latin names and nomenclatural types in this context will be considered. Various examples will be cited to show the impact of the problems on botanist and cultivator, and the appropriate type of name in each case will be discussed.

Greguss, Paul. Université, Szeged, Hongrie. *Die Entdeckung der Urcormophyten in Ordovicien.* Laut der allgemein verbreiteten Auffassung waren die devonischen Psilophyten die einfachsten Cormophyten, aus denen sich als gemeinsamer Stamm die drei Hauptklassen der Pteridophyten uzw. die *Lycopsiden, Pteropsiden* und *Sphenopsiden* entwickeln haben konnten. Die Zimmermannsche "Telomtheorie" leitet die drei Hauptverzweigungs-Typen der Pteridophyten aus der Dichotomie ab und führt auch die Bryophyten als Abkömmlinge der Seetangen zurück. Nach den neuesten Entdeckungen müssen aber diese Auffassungen unbedingt modifiziert werden. Der polnische Professor Kozlowski preparierte aus den Ordovicien stammenden sog. "Ostseekalk" sehr primitive Pflanzenreste heraus und betraute mit der weiteren Bearbeitung den Verfasser. Der Verf. konnte feststellen dass diese winzigen kaum 2-10 mm. hohe Pflänzchen schon echte Wurzel und Wurzelhaaren, primitive Leitungselemente besassen; ihre Stämme waren entweder unverzweigt oder wenn sie sich verzweigten, dann war die Verzweigung entweder monopodial, oder dichotom. Fehlten aber noch die Spaltöffnungen und die Blätter, höchstens nur kurze oder längere Haargebilde bedeckten den winzigen Stamm, und bildeten sie wahrscheinlich eine Übergangsstufe zwischen den heute lebenden Bryophyten und den ausgestorbenen Psilophyten. Eben deswegen nennt der Verf. diese eigentümlichen Pflänzchen *Propsilophyten.* Entwicklungsgeschichtlich ist der Umstand besonders bedeutungsvoll dass zwei moosähnliche Typen schon in Ordovicien in gleicher Entwicklungsstufe nebeneinander lebten und ebendeswegen – laut dem Verf. – könnten sie sich nicht auseinander oder aus den Seetangen entwickeln. Der Verfasser nennt den einen monopodial verzweigten und den Musci-ähnlichen Typ: *Musciphyton* und den dichotom verzweigten den Hepaticae-ähnlichen Typ: *Hepaticaephyton.* Er konnte cca 8-10 verschiedene Arten unterscheiden.

GREULACH, VICTOR A., and JOHN G. HAESLOOP. University of North Carolina. *Effects of Gibberellic Acid on Cellular Growth in Lycopersicum esculentum.* We could ascribe all growth promotion by gibberellic acid (GA) in *Phaseolus vulgaris* (1958) to increased cell division in tissue taken four weeks after treatment, and other investigators have found that stimulation of cell division plays an important role in GA-induced growth in contrast with earlier reports stressing increased cell elongation. We have now found that in *Lycopersicum esculentum* GA stimulates both cell elongation and cell division, the increase in cell number occurring entirely subsequent to our 96-hour sample. Increase in cell number was steady in GA-treated plants as was increase in cell size, but in the controls cell number fluctuated widely in regular 48-hour cycles, cell size following a similar but reversed cycle. The cycles may result from alternating variations in the rates of cell elongation and cell division. Our data substantiate the findings of Bindloss (1942) and Sachs, Bretz, and Lang (1959) that much more cell division occurs outside the apical meristem than is generally recognized. GA may initially promote increases in cell length, but subsequent cell divisions may eventually reduce cell length in GA-treated stems until it is essentially the same as in the controls.

GRIFFITH, T. *See* BYERRUM, R. U.

GRUEN, HANS E., and GEORGE M. CURRY. Harvard University and Tufts University. *Action Spectra for the Positive and Negative Phototropism of Phycomyces Sporangiophores.* Action spectra for the positive phototropism of *Phycomyces* sporangiophores in the visible range and for negative phototropism in ultraviolet were obtained by means of the balance method. Monochromatic light was isolated from a mercury or tungsten lamp with a grating monochromator and appropriate supplementary glass filters. For studies in the visible range the cultures were placed at intervals between the monochromator and a "standard" blue light set at 2 m. distance, and for the ultraviolet the "standard" blue light was replaced by a small sterilamp (254) mμ). The relative quantum effectiveness at each wave-length was calculated from the ratio of the intensities measured at each balance position where the sporangiophores failed to curve towards either light source. The action spectrum for the positive response shows three peaks, the highest near 445 mμ, a second near 470 mμ, and a lower peak near 375 mμ. Wave-lengths longer than 525mμ had no effect. The action spectrum for the negative response shows a single peak near 280 mμ, a trough near 255 mμ, and a steady rise below this. The upper wave-length limit is near 315 mμ. Both visible light and UV give a transient growth promotion. The action spectrum for this response was explored in visible light, and showed similarities to the phototropic action spectrum. The action spectrum for the positive phototropism closely resembles that of *Avena.* These spectra point more towards a carotenoid than to riboflavin as a possible photoreceptor.

GUINOCHET, M. Université de Paris (Sorbonne). *Le Problème de la définition mathématique des groupements dans le cadre de la phytosociologie Zuricho-Montpellieraine.* Le travail de base du phytosociologue repose sur la comparai-

son de listes floristiques convenablement établies. Ce qui implique les opérations suivantes: (1) Choix de l'emplacement et des dimensions des relevés. Ils doivent être exécutés sur une surface floristiquement homogène, c'est à dire n'intéressant qu'un seul "individu d'association". Cela n'a aucun rapport avec la distribution des individus des diverses espèces sur cette surface. (2) Distribution des relevés en groupements tels que les relevés dont ils sont constitués se ressemblent floristiquement plus entre eux qu'ils ne ressemblent aux autres. Ici la méthode de l'analyse différentielle de Czekanowski peut rendre d'utiles services. D'autre part, l'expérience et la théorie montrent que la distribution des fréquences des espèces dans un tableau d'association correct obéit au type I de l'équation généralisée des probabilités de K. Pearson. L'ajustement des données d'un tableau d'association à cette équation est un bon test pour déterminer s'il ne comporte pas de relevés étrangers au groupement qu'il définit. Cette homogénéité n'a rien à voir avec la distribution des signes dans le tableau ou avec l'homogénéité du groupement, qui, elle, dépend de la proportion relative des espèces de haute et de faible présence. Ces considérations mathématiques ne modifient en rien l'esprit et les méthodes de la Phytosociologie Zuricho-Montpellieraine classique auxquelles il n'est nullement question de les substituer, bien qu'elles puissent rendre d'utiles services pour la solution de cas délicats. Elles en sont surtout une justification théorique *a posteriori* et un complément permettant d'obtenir une vue plus pénétrante de la signification des groupements végétaux.

GULISASHVILI, V. Z. U.S.S.R. *On the Regularities in the Development of Arboreal Plants.* Two cycles of development are peculiar to the ontogenesis of arboreal plants: a great cycle — from the seed to the death of the plants; and a small yearly cycle, consisting of the change from active growth to resting. The great cycle of development is represented by stages of youth, full growth, and maturity. During the period of resting, the plants go through an obscure stage and during that of active growth through an obvious stage of development. During the stage of resting — the obscure stage — processes go on in the buds which are indispensable since the next, easily observable stage of development, characterized by growth, blossoming, and foliation, is impossible without them. The small cycles of development are component parts of the great one. Most arboreal plants of the cold climate belong in the category of winter forms. They are unable to start growing, to form foliage, or to blossom without the influence exerted on the buds by low temperatures in winter, and, therefore, are characterized by a single period of growth, foliation, and blossoming in a year. Arboreal plants of tropical and subtropical climates, and some plants of temperate climates, are spring forms and can go through the obscure phase without being influenced by low temperature; therefore, they have several changes from growth to resting stage in a year. Winter and spring forms have been produced in the process of historical development. The essential factor of phylogenetic development of arboreal plants is the inner contradiction in their heredity, especially well expressed in relicts of the temperate zone. On the one hand, they are well adapted to present-day climatic conditions, being characterized by sufficient frost-resistance; on the other, they are endowed with some features of plants of tropical climate, expressed in their ability to blossom two or three times, to give several growths in presence of cauline flowering, etc. The development of arboreal plants continues with a gradual dying off of old elements and an accumulation of new hereditary features.

Guminski, S., et Z. Guminska. Université de Wroclaw, Pologne. *Le Mécanisme d'action physiologique des Composés humiques sur l'organisme végétal.* Les résultats de nos travaux, qui ont été publiés au cours de dernières années, nous permirent de conclure que l'action du humate de soude était stimulante sur la croissance végétale alors que les conditions de respiration des racines étaient infavorables. Par contre, cette action dépérit lorsque les conditions de l'oxygène s'avèrent favorables. On a obtenu le résultat physiologique identique en employant l'humate artificiel préparé avec le p-benzoquinon ou avec l'acide gallique. Les investigations ont demontrées, que l'humate augmente le dégagement du gaz carbonique en défaut d'oxygène. L'application des inhibiteurs respiratoires dans l'experiment végétative nous a permis de poser l'hypothèse suivante: l'humate induit en supplément l'oxydation biologique à l'aide de l'oxydase polyphénolique, il sert de même comme accepteur de l'hydrogène dans quelque fermentation. On a récemment effectué des experiences concernant l'influence de l'humate naturel et des substances chimiquement analogues sur la germination des graines. On a constaté une stimulation intense, mais seulement dans le cas du défaut d'oxygène. Dans ces conditions l'humate augmentait simultanément le dégagement du gaz carbonique par les graines. A part cela on a recherché l'influence de l'humate sur les microorganismes en culture, dans laquelle croissaient les plantes examinées. On a également examiné la reactivité chimique et physico-chimique de l'humate en rapport aux produits du metabolisme des racines dans la culture.

Guminska, Z. *See* **Guminski, S.**

Gunckel, James E. Rutgers University. *Changes in Apical Meristems Induced by Ionizing Radiation.* Plants were irradiated with X- and gamma-rays to see if the basic growth patterns of apical meristems could be changed in plants where the particular pattern and resulting differentiation had been described. *Avena sativa, Linum perennis, Vicia faba,* and *Datura stramonium* range from one to four tunica layers and *Ceiba pentandra* has a central mother-cell zone. In addition, a flower bud series was collected from *Nicotiana glauca, N. langsdorffii,* and *N. glauca* × *langsdorffii* plants exposed to dosages of 25-400 r per day gamma-rays for six weeks. Cytological changes, usually increased viscosity or hydration, were followed by a regular series of changes with increasing dosages—vacuolation and cell enlargement, reduction in the number of cells in division, arrest of growth, and loss of apical dominance – all without change in the original patterns. At the highest dosages the apices broadened and flattened, some cellular breakdown of tunica occurred, dichotomies appeared or new meristems formed from underlying cells of the corpus, and finally cells died. Floral and vegetative apices may differ in their response. Differences in radiosensitivity of tunica and corpus indicate physiological rather than genetic differences since, if not too disorganized, the normal growth pattern may be restored during a recovery period. The totipotency of meristematic cells is clearly demonstrated, but self-determination is questionable.

Gupta, K. M. Jaswant College, Jodhpur, India. *Morphology and Systematics of the Water Fern Marsilea and the Problem of Speciation in the Genus.* The genus *Marsilea* in India has been a subject of intensive study for the last five years. Besides a new species and a number of new varieties, more than one foreign species have been discovered in the Indian flora. Not only have our present morphological and systematic investigations substantially added to our knowledge but they have also tended to indicate the future lines of work, especially the cytological aspects, so that in the near future the entire *Marsilea* complex will be worked out and the problem of speciation in the genus solved. While edaphic and other environments always influence the life of plants, ecological factors of hydrophytism or xerophytism seem to play a dominant role in *Marsilea.* The leaves and the sporocarps are the most affected organs externally and internally. The range of variations within the species and within the genus has been worked out by subjecting ten different types to autecological investigations under experimental conditions, thereby establishing what may be called the hereditary or environmental distinctions among these Indian types. As a result of these studies the phenomenon of the occurrence of normal bisexual sporocarps and sporocarps without megaspores has been established — especially in widely distributed species such as *M. minuta* or the American species *M. vestita.* The possible trends in speciation by either ecological isolation or loss of sexuality have been studied.

HAAS, THEODOR P. Philadelphia College of Pharmacy and Science. *Observations on Some Utricularia Species.* I shall talk about *Utricularia inflate, purpurea,* and *subulata-eleistogama,* native to eastern North America, which I studied in the New Jersey pine barrens, and *Utricularia endresii,* which I saw near San Jose, Costa Rica, in the summer of 1957.

HABER, ALAN H., and HELEN J. LUIPPOLD. Oak Ridge National Laboratory. *Dormancy Induced by Gamma Irradiation of Dry Lettuce Seeds.* Dry New York lettuce seeds given 300–1,000 kr of gamma radiation show inhibition of germination when subsequently put in water. That this failure to germinate is caused by seed dormancy is suggested by the fact that such irradiated seeds will germinate if treated with any of the following agents: gibberellic acid, kinetin, thiourea, pricking, or light. Germination was always accompanied by both cellular expansions and cell divisions irrespective of radiation and chemical treatments. The first four agents mentioned were fully effective under conditions for which continuous white light was only slightly effective. The chemical treatments, which protected against the effect of gamma radiation on germination, showed no protection against the following gamma-radiation effects: inhibition of respiratory rates, production of chromosomal aberrations, and reduction of seedling height. Consequently, the chemical treatments that enabled gamma-irradiated seeds to germinate had radioprotective activity specific for the germination process. These results further support the conclusion that the gamma radiation prevented germination by inducing dormancy, and preclude alternative explanations in terms of killing, inhibition of growth, or mitotic inhibition.

HACKETT, D. P. University of California. *Oxidation Mechanisms in Plant Mitochondria.* There is now good evidence, obtained with both intact tissues and isolated cell fractions, that the mitochondria serve as the principal respiratory centers in plant cells. Particulates isolated from a wide variety of tissues can oxidize organic acids via the Krebs cycle, transport electrons from substrates to oxygen, and carry out an efficient oxidative phosphorylation. The cytochrome system plays a central role, with electron transfer proceeding through a chain of pyridine nucleotide, flavoprotein, cytochromes b, c, and a-a_3. The relative concentrations of the cytochromes of the plant respiratory chain may differ from those found in animals. Studies on the respiration of cyanide- and CO-resistant plant tissues have directed attention to some unusual properties in the cytochrome b region. Although some evidence suggests that a direct electron transport pathway from mitochondrial cytochrome b_7 to oxygen may operate, the possibility that a residual fraction of c and a-a_3 is still active in the presence of inhibitors has not been completely eliminated. Low concentrations of cyanide and CO can "uncouple" oxidative phosphorylation from electron transfer. A number of physiological processes have been analyzed in relation to the respiratory activities in the mitochondria.

HACSKAYLO, EDWARD. U.S. Forest Service. *Factors Influencing Mycorrhizal Development in Some Cultural Practices.* There is little experimental evidence indicating the role of endotrophic mycorrhiza in survival of tree species, but physiological responses by the root systems of such species to critical concentrations of indoleacetic acid differ from the responses of species forming ectotrophic mycorrhiza. However, mycorrhiza are important for ectotrophic tree species growing in soils of low available inorganic nutrients. Soil texture, moisture, and aeration greatly influence the morphology of the root systems and the number and morphology of the mycorrhiza in ectotrophic species. The level of soil moisture may determine which species of fungi may be found in mycorrhizal association with pine. Though one to several are in active association with a single plant at any one time, experimental determination of the more productive species of fungi followed by appropriate inoculation procedures may increase growth. Soil fumigation prior to seeding can alter the complex of soil fungi, and proper procedures should enable removal of undesirable fungus species resulting in increased growth of seedlings. Such a technique would be useful in determining relative efficiencies in nutrient absorption of individual fungi in the ectotrophic association.

HADDOW, W. R. Ontario Department of Lands and Forests. *Effect of Blister Rust (Cronartium ribicola Fisch.) on the Growth and Management of White Pine Forest.* From periodic measurements and observations within a defined area of typical mixed forest near Dorset, Ontario, normal increment of white pine was calculated, and actual and prospective losses on account of blister rust were determined. Viewed in relation to silvical conditions and length of exposure to the disease to date—and in consideration of the probable rotation for pine—these data permit the evaluation of blister rust damage in reference to the aims and methods of forest management.

HAESLOOP, JOHN G. *See* GREULACH, VICTOR A.

HAGEN, GEORGE LEONARD. Harvard University. *Tumor Formation in the Hybrid Tobacco Nicotiana glauca × N. langsdorffii.* The hybrid tobacco *Nicotiana glauca × N. langsdorffii* will form tumors spontaneously. Tumor production can be increased by treating growing plants with ionizing radiation. Because the site of tumor has not yet been specifically determined a technique has been devised whereby this site can be localized. Seeds of the hybrid are sterilized in Chlorox/H_2O (5/95) for five minutes. They are then washed in two changes of sterile distilled water (5 min./wash) and sewn on sterile filter paper in petri dishes to which half-strength nutrient solution has been added. After four days of germination the seedlings are irradiated with an acute X-ray dose of 1,800 r. They are then allowed to grow under constant conditions. From the fourth to the twelfth day following irradiation tumor initiation can be observed in the apex. Controls show no similar tumor formation. Physiological and histological characterization of these tumors and of control plants will be presented.

HAIDLE, C. W. *See* KNIGHT, S. G., *et al.*

HALE, JOSEPH D. Forest Products Laboratories of Canada. *The Definition of Normal Characteristics of Variable Timber Species.* In sampling trees to appraise wood quality, anatomists of the Forest Products Laboratories of Canada suggest a method that reveals average technological properties of variable species in the form of graphs indicating the normal patterns of variation brought about in wood by age and environment. Species are sampled in areas of recognizable ecological type (i.e, site) so as to obtain trees representing the range of diameters in each significant age class in the forest area. Properties of wood (e.g., specific gravity and cell dimensions) are traced throughout the trunk by stem analysis so that trends of variation may be charted by position in the tree. Average properties representing whole stems may also be plotted as ordinates against diameter classes in order of magnitude as abscissae. Every species may, therefore, have a group of curves as "norms" for each site, each curve representing variation in S.G. among small to large diameters in the same age class. Trees having significantly high or low S.G. for their class become conspicuously noted for anatomical observation to determine whether exceptional qualities result primarily from exceptional environment or exceptional inheritable characteristics. Use of such analysis is suggested to distinguish trees with superior characteristics propagable by inheritance.

HALE, MASON E. Smithsonian Institution. *Systematics of the Parmelia trichotera Group in North America.* The *Parmelia trichotera* group in North America includes six species, *P. arnoldii* DR., *P. maxima* Hue, *P. margaritata* Hue, *P. trichotera* Hue, and two undescribed species, all of which have marginal soredia and cilia and a brown underside. These plants are differentiated by chemical characters and by origin of soredia.

HALL, BENEDICT A. New York State University Teachers College. *Inflorescences in the Aceraceae.* The literature concerning inflorescences is confused by concepts that do not fit the facts; further study, based on careful gross and anatomical observations, is needed. The Aceraceae provide excellent material for such a study since they include a wide variety of inflorescence types within a group of closely related species. The usual distinction between racemose and cymose inflorescences does not fit the data of this study. The simple raceme of *Acer grosseri*, for example, has a terminal flower and lacks the acropetal sequence of anthesis. A more valid distinction is that between monopodial and sympodial branching; but this does not separate the inflorescences into two types since in *A. mono* the primary branching of the inflorescence is monopodial while these branches are in turn sympodially branched, forming bostryches. Further complexities involve the various patterns of distribution of male and female flowers in the inflorescences. The Aceraceae furnish confirmation of the view that simpler inflorescence types have been derived phylogenetically from more complex ones through loss of branches and the shortening of internodes. The present data can contribute to our understanding of phylogenetic relations within the Aceraceae, as well as of the nature and evolution of inflorescences in general.

HALL, C. V. *See* DUTTA, S. K., *et al.*

HALLDAL, PER. University of Lund, Sweden. *Factors Affecting the Light Response in Phototactic Algae.* Most motile algae react to light by swimming either toward a light source (positive phototaxis) or away from it (negative phototaxis). In some cases a non-phototactic reaction occurs. A reversal from positive to negative phototaxis and vice versa has been shown to occur in all the species examined (Dinophyceae and Volvocales). Based upon experiments mainly with the brine flagellate *Platymonas subcordiformis* (Wille) Hazen (Volvocales) Gibor's strain, the following conclusions have been made. (1) The light intensity is primarily not responsible for the change from positive to negative phototaxis and vice versa. (2) The intensity of the light may affect phototaxis secondarily in that algal photosynthesis alters either the environmental conditions (pH, salt balance), or the physiology of the algae. (3) It has not been possible to induce immediate response changes by altering the CO_2-pressure, the O_2-pressure, or the total gas pressure in the medium. (4) Calcium and magnesium ions are necessary for movement. In the absence of both these ions all movement stops. For *Platymonas* Ca^{++} causes a negative phototaxis and Mg^{++} a positive phototaxis (at low K^+ concentration, see below). (5) The motility and phototactic activity is greatly influenced by K^+. A random motion situation is obtained at a Ca^{++} $-K^+$ balance following the empirical formula: $Ca^{++} = 0.015^{+2,76}$. where Ca^{++} and K^+ are the concentrations of calcium and potassium in $10^{-3}M$. (6) The pH-activity curves for positive and negative phototaxis are the same. No motion occurs below pH 5.2. The motility and phototactic activity are rather constant and close to maximum between pH 6.5 and 8.5. The motility drops to zero at pH 9.5.

HALLER, JOHN R. University of California. *The Role of Hybridization in the Origin and Evolution of Pinus washoensis. Pinus washoensis,* described by Mason and Stockwell in 1945, occurs as a distinct entity only on a few restricted high morainal slopes on Mount Rose in western Nevada. In this restricted area, *P. washoensis* occurs sympatrically with *P. jeffreyi,* but the two species do not appear to hybridize at present. There is evidence, however, that *P. washoensis* may have arisen through introgression of *P. jeffreyi* into *P. ponderosa,* possibly as recently as the Pleistocene epoch. *Pinus washoensis* has apparently failed to establish any effective isolating mechanisms between itself and *P. ponderosa,* and on the non-morainal slopes at relatively low altitude where the two species are sympatric, *P. washoensis* is being "swamped" by hybridization. However, this hybridization is also affecting *P. ponderosa* in the area, and may eventually produce a new geographic race, distinct from the original *P. ponderosa,* that could, owing to the influence of *P. washoensis,* be better adapted for survival in the severe environment in which the hybridization is now taking place.

HAMNER, K. C. *See* SIROHI, G. S.

HAMNER, KARL C. University of California. *Endogenous Rhythms in Relation to Photoperiodism.* Growth chambers are described wherein plants may be exposed to any desired length of photoperiod and dark period in cycles ranging in length from 16 to 72 hours. Various photoperiodically sensitive plants have been exposed to a wide range of cycle lengths containing light periods and dark periods of different durations. The results indicate that the photoperiodic responses of some plants, and perhaps of all plants, may be under the control of an endogenous rhythm, at times promoting and at times inhibiting the flowering response. In short-day plants, the inhibitory phase of the rhythm is at a minimum on cycle lengths of 24, 48, and 72 hours and at a maximum on cycle lengths of 36 and 60 hours. The critical length of the dark period in photoperiodically sensitive plants appears to be associated with this rhythm.

HANCOCK, C. R. *See* BARLOW, H. W. B.

HANSING, E. D. *See* DUTTA, S. K., *et al.*

HANSING, EARL D. Kansas State College. *Correlation between Loose Smut Infection of Wheat under Artificial and Natural Conditions.* For artificial infection, inoculum of prevalent races of *Ustilago tritici* was used. For natural infection, several hundred farmer-samples from different counties were selected at random each year for 12 years. Infected seed from both groups was grown in the nursery. The percentages of smutted heads from artificial compared with natural infection, respectively, follow: Resistant varieties: Pawnee, 2, 0.001, Triumph, 10, 0.008, and Ponca, 11, 0.03; susceptible varieties: Comanche, 47, 0.04, Wichita, 48, 0.2, Tenmarq, 51, 0.3, Concho, 52, 0.5, Cheyenne, 57, 1.5, and Red Chief, 64, 2.2. The degree of resistance between susceptible and resistant varieties was much greater under natural infection than under artificial infection. The ratio for natural compared with artificial infection for Pawnee was 1:2,000, while that for Red Chief was 1:29; or, Pawnee was 69 times (2,000/29) more resistant under natural conditions than anticipated from artificial infection. Similarly, Triumph and Ponca, with ratios of 1:1250 and 1:367, respectively, were 43 and 13 times more resistant, and Comanche and Wichita, with ratios of 1:336 and 1:240, were 12 and 8 times more resistant than Red Chief. The ratios between artificial and natural infection plotted against artificial infection indicated a linear relationship for resistant varieties, and a curvilinear relationship for susceptible varieties.

HANSON, J. B. *See* VATTER, A. E.

HANSON, JOHN B. University of Illinois. *Physiological and Biochemical Aspects of Root Development.* Over the past decade there has arisen an increased interest in the physiological, biochemical, and cytological aspects of root activity as a function of cell development. Respiration and salt accumulation per cell or per unit protein increase as the meristematic cell expands. Biochemically there is an increase in phospholipide and protein, and in the activity of some enzymes, including those of the mitochondria. Electron micrographs show several cytological changes to accompany cell development, the most marked being the disappearance of the microsomal (ribonucleoprotein) granules, and the appearance of much membranous material (ergatoplasm). Mitochondria also appear to become more membranous and isolated mitochondria can be shown to synthesize constitutive lecithin. The increases in respiration and salt accumulation with cell development appear to be attributable to the RNA associated with developing membranes. Mitochondrial oxidation and phosphorylation depend upon polynucleotides; ion accumulation seems similarly dependent. The association of RNA with membranes seems to be a function of expansive growth and divalent ions. It is postulated that the chemical constituent primarily responsible for increased physiological activity is RNA, inherited as a "capital" of microsomal granules by the daughter cell, and metabolized under the hormonal control of auxin into developing membranes.

HARE, F. KENNETH. McGill University, Montreal. *One to One Million Vegetation Maps of the Labrador Peninsula.* The author has recently completed one to 1 M vegetation maps of the entire Labrador peninsula north of a line from Lake St. John to Moosonee. A corresponding series of physiographic maps has also been completed. Both series will be demonstrated at the Symposium. Survey methods were based upon air photo interpretation. The use of large-scale air photographs (1 to 40,000 on the average) in preparing maps of this scale involves the adoption of a very coarse physiognomic classification for both vegetation and land forms. The resulting maps show zonal sub-divisions in far greater detail than any of their predecessors, but are of limited value to the ecologist.

HARNEY, PATRICIA M. Macdonald College of McGill University, Montreal. *Some Effects of Seed Treatment with the Anti-auxin Maleic Hydrazide (MH) on Tomato Chromosomes.* Tomato seeds treated with aqueous solutions of maleic hydrazide (10^{-2} *M*, 10^{-3} *M*, 10^{-4} *M*) have produced some interesting cytological features. Root tip squashes scored for anaphase aberrations have shown both bridges and fragments with frequencies up to 48 per cent for different treatments. These cytological abnormalities have been shown to persist in the C_2 generation of root tips from germinated seed, root tips from growing plants as well as in the pollen mother cells. It would appear that the anaphase bridges are being carried over to the following generation by a breakage-fusion-bridge cycle, as has been reported in maize and a few other plants. Phenotypically, MH seems to increase the frequency of "rogue" tomatoes in the second generation, as well as induce a number of unclassified abnormals. Root tip examination of these shows a frequency of abnormal anaphases as high as that of the C_1 generation. Pollen mother cells show a very high incidence of bridges and fragments. However, no apparent sterility of pollen has been noted over controls.

HARRIS, B. J. University College of Ghana. *Pollination of Flowers by Bats in the Tropics.* In the Tropics, there occur species of flowering plants (especially amongst the families Bignoniaceae and Bombacaceae) whose flowers are visited for nectar and pollen by fruit-bats (Megachiroptera) which thereby bring about pollination. Pollination by bats (cheiropterogamy) does not occur in temperate regions because fruit-bats are confined to the Tropics. In Ghana, observations have been made and photographs taken of visits by *Eidolon helvum, Epomophorus gambianus, Nanonycteris veldkampii,* and *Micropteropus pusillus* to flowers of the baobab (*Adansonia digitata*), kapok (*Ceiba pentandra*), the sausage tree (*Kigelia africana*) and *Parkia clappertoniana.* The importance to the plants of these visits by fruit-bats to their flowers is discussed and the necessity for further observations, especially in the New World, is emphasised.

Harris, Tom M. University of Reading, England. *The Anatomy of the Seed of Caytonia.* The seed of Caytonia is small (1 mm. long) and only known from compressions, but maceration reveals at least eight different layers. Some of these have been re-interpreted. Salient features are the lack of any cuticle on the megaspore membrane, and the presence of a thick, almost complete cuticle round the nucellus, in both of which it is angiospermous rather than typically gymnospermous. Its pollination (pollen received in the nucellar pollen chamber) is however purely gymnospermous. The least different seeds so far known are those of certain Bennettitales and some isolated seeds associated with Glossopteris.

Harrison, B. G. Rothamsted Experimental Station, Harpenden, England. *Soil-borne Virus Diseases of Plants.* Although by 1900 at least two diseases now known to be caused by viruses, tobacco mosaic and tobacco rattle, were believed to be transmitted through the soil, the study of soil-borne virus diseases has since then been neglected. Recent work has shown that soil-borne viruses are both widely disseminated and associated with many diseases of economic importance. At least fifteen viruses are soil-borne, and these fall into five groups, of which tobacco mosaic, wheat mosaic, tobacco necrosis, grape fanleaf, and tomato black ring are examples. Several other viruses whose modes of spread are unknown but whose general properties resemble those of soil-borne viruses are probably also soil-borne. Different groups of viruses probably have different mechanisms of surviving in soil and of infecting plants. Thus, when tobacco mosaic virus overseasons in soil, it probably infects by mechanical contact of the new crop with old plant residues, whereas soil-inhabiting organisms apparently play a part in the transmission of viruses in three other groups. Recent studies on the behaviour characteristic of each group of soil-borne viruses, mechanisms of transmission, and control measures, and the significance of soil transmission will be discussed.

Harte, Cornelia. Universität Köln. *Cytological and Genetic Studies on Mutants of Cenothera Originating after Irradiation with Radio Waves.* In several experiments with *Cenothera Hookeri* pollen grains were irradiated with radio waves (wavelength 2 and 3 m.) for 2 and 4 hours, and plants were irradiated during the whole vegetation period. In the second generation following the irradiation, we found several mutants and a great number of mosaics with sectors of small leaves. These plants were not only phenotypically but also genetically mosaics. In some cases the small-leaf sector was homozygote for a mutation, the normal parts of the plant being heterozygote, in other plants the phenotypic normal part was genetically homozygote normal, the abnormal part heterozygote for genes, which influence the form of the leaves. Some of the mutants have normal chromosomes, others have a reduced chiasma frequency or a reciprocal translocation with one break in the heterochromatic middle region of one chromosome, the second break in the euchromatic end of another chromosome. It may be that there is a position effect in these mutants. The demonstration will show the pedigree of the mosaics and mutants, photographs of the different phenotypes, microphotos, drawings, and tables of the cytology of the mutants and illustrations of the phenogenetic analysis of the development of the leaves of the mutants.

HARTMANN, W. *See* MÜLLER-STOLL, W. R.

HASSID, W. Z., D. S. FEINGOLD, and E. F. NEUFELD. University of California. *Role of Sugar Nucleotides in the Interconversion of Carbohydrates in Plants.* Sugar nucleotides, known to be widely distributed in nature, have been shown to play an important role in intermediate carbohydrate metabolism of living cells. It has been found that mung beans contain a mixture of sugar nucleotides consisting of uridine diphosphate (UDP) glucose, UDP-galactose, UDP-xylose, UDP-arabinose, and UDP-glucuronic acid. These plants, as well as others, also contain enzymes (pyrophosphorylases) capable of catalyzing the formation of these sugar nucleotides. Other enzymatic systems have been shown to exist in plants as follows: (*a*) kinases capable of phosphorylating D-glucuronic acid, D-galactose, and L-arabinose at carbon 1 position, forming sugar phosphates which react with uridine triphosphate in the presence of plant pyrophosphorylases to produce the corresponding sugar nucleotides; (*b*) a UDP-dehydrogenase which oxidizes UDP-glucose to UDP-glucuronic acid; (*c*) a decarboxylase capable of decarboxylating UDP-glucuronic acid to UDP-pentose; (*d*) enzymes (4-epimerases) that catalyze the interconversion of UDP-xylose and UDP-arabinose, UDP-glucose and UDP-galactose, and UDP-glucuronic acid and UDP-galacturonic acid: (*e*) transglucosylases that catalyze the formation of sucrose, callose (β-1,3-linked glucan), and a number of naturally occurring glycosides from UDP-glucose; and (*f*) a transxylosylase which transfers xylosyl residues from UDP-xylose to xylo-oligosaccharides. It is believed that sugar nucleotides may be implicated in the synthesis of oligosaccharides such as the raffinose series, and cell-wall constituents such as cellulose, xylan, araban, hemicellulose, and pectin.

HATTORI, S. Obi, Nichinan-shi, Kyushu, Japan. *Takakia, a New Taxon of Hepaticae. Takakia* was described by Hattori and Inoue (Jan. 1958). Its karyology was dealt with in Tatuno's paper (July 1958). Hattori (July 1958), Hattori and Mizutani (July 1958), and Hattori *et al.* (Dec. 1958) consider that a new order (or possibly sub-class or class) is needed for this plant although it is related to the Calobryales in many respects. The following are among its remarkable features: (1) the plant is wholly destitute of rhizoids, but a fungus occurs in scattered clusters on the epidermis; (2) phyllotaxy appears to be entirely irregular, but in principle pairs of cylindrical "leaves" arise in three ranks, and no dorsiventrality can be recognized; (3) the "n" number of chromosomes is four, its kariotype being 4V + 4J; (4) archegonia arise on shoot-tips among crowded young "leaves" and styli, neither perichaetium nor perigynium being developed, and the apical cell itself does not take part in the archegonial formation. In conclusion, *Takakia* should represent a proper taxon higher than family (at least an order). However, discovery of sporophytes (and androecia as well), it is hoped, will decide its systematic position.

HATTORI, SHIZUO. *See* MITSUI, SEIJI, *et al.*

HAUPT, W. University of Tübingen. *Flower-promoting versus Flower-inhibiting Substances.* First, evidence for the existence of flower-promoting or inducing substances is presented, which cannot be explained in terms of the absence of inhibiting substances alone. For example: the translocation of the stimulus out of the *Xanthium* leaf; the summation effects of Carr; and the author's grafting experiments with peas. In the last of these, flowering of the scion (late-flowering variety) is promoted by the stock (early-flowering variety) even when the scion has its cotyledons intact. This result is in conflict with Barber's view, according to which flowering in peas is limited primarily by a flower-inhibiting substance, present in the cotyledons of late varieties, which when leached out of the young stems results in flower promotion. Thus, the question is not whether there is "promotion or inhibition," but whether or not there are inhibiting substances in addition to flower promotion. Barber's results seem to point to this additional effect. My own experiment, mentioned above, also shows some inhibiting effect of the cotyledons situated between stock and scion even though the inducing effect of the stock is clearly evident. A further complication arises from Doorenbos' results in experiments on rejuvenation by grafting in *Hedera*. This seems to be connected with flower inhibition whereas flower formation in this plant has not been induced by grafting. Finally, attention is called to the possibility of explaining some inhibiting effects caused by changes in the translocation of promotive substances, but the opposite can be true as well. In crucial experiments, therefore, simultaneous translocation experiments, as conducted by Chaylakhyan, are recommended.

HAWKSWORTH, FRANK G. U.S. Forest Service. *Dwarfmistletoes of Ponderosa Pine.* The dwarfmistletoes (*Arceuthobium* spp.) are the most important pathogens of many western conifers, including ponderosa pine (*Pinus ponderosa* Laws.). Two species attack this tree: *A. campylopodum* f. *campylopodum* on the Pacific Coast and *A. vaginatum* f. *cryptopodum* in the Southwest, but this discussion pertains only to the latter species. This paper deals primarily with ecological relationships as little is known of the physiology of the dwarfmistletoes. In natural stands, severe forest fires are of major importance in limiting the distribution of dwarfmistletoes. Heavy logging may have much the same effect as fires although partial cuttings usually stimulate the parasite in residual trees. In the Southwest, there is little or no relation between site quality and prevalence of the parasite. Information from one area in southern New Mexico shows that the frequency of dwarfmistletoe is highest on south and southwest exposures and least on the northeast. Its frequency is slightly higher on gentle than on steep slopes. It is most common on ridges, less common on side hills, and least common in bottoms. The frequency of the parasite is highest at the medial altitudes of the host range and decreases towards the host's upper and lower limits.

HAXO, FRANCIS T. University of California. *The Functioning of Pigments other than Chlorophyll in the Photosynthesis of Several Flagellates.* Determinations have been made of the photosynthetic and corresponding absorption spectra of several flagellates in which pigments in addition to chlorophyll contribute markedly to cell absportion. The cryptomonads examined contained copious amounts of single-peaked chromoproteins of the phycobilin type, in company with chlorophyll *a*, chlorophyll *c*, and carotenoids. Maximum photosynthetic activity for *Rhodomonas lens* (red-colored) was observed at 555 mμ, and for *Cryptomonas ovata* (brown-colored) at 567 mμ, in agreement with the prominent *in vivo* absorption maxima of their respective phycoerythrins. Light absorbed directly by chlorophyll was utilized with a somewhat lower effectiveness, but not as low as that characteristic of the Rhodophyta. *Gonyaulax polyedra* contained a complement of pigments expected for dinoflagellates: namely, the polyoxy carotenoid peridinin in abundant amounts, chlorophyll *a*, chlorophyll *c*, and other carotenoids. Peridinin accounted for most of the light absorbed by *Gonyaulax* in the spectral region 500-550 mμ, at least 80 per cent of which was available for photosynthesis. It is concluded that peridinin of dinoflagellates plays a similar role in the photosynthesis of dinoflagellates as does fucoxanthin in the diatoms and the brown algae.

HAYASHI, KÔZÔ. See MITSUI, SEIJI, *et al.*

HAYASHI, T. National Institute of Agricultural Sciences, Tokyo. *The Discovery and Physiological Action of the Gibberellins.* The disease of the rice plant known by the Japanese name of Bakanae-byo is often found in Japan and is reported to occur in Taiwan, India, and other countries. The affected seedlings become taller and thinner than the normal ones and are easily distinguished in the seed bed. In 1926 Kurosawa succeeded in producing the bakanae effect in rice seedlings by treating them with a culture medium in which bakanae fungus had been grown. In the early 1930's, Yabuta and the author initiated the isolation of the growth-stimulating substance using Kurosawa's medium, and in 1935, Yabuta announced the growth stimulant had been isolated as a fairly pure solid substance, to which he gave the name gibberellin. Later, in 1938, Yabuta and Sumiki reported the isolation of crystalline gibberellin A. As to the physiological action of gibberellins, the present paper deals particularly with the dry weight increase in plant parts and the changes in the enzyme pattern of the gibberellin-treated plant. Treated plants increased the rate of photosynthesis and dry weight, the latter being due to the increase in cell-wall materials. All the enzyme activities studied in treated rice plant were decreased, except peroxidase and invertase which increased.

HAZEN, E. L. *See* EDWARDS, M. R., *et al.*

HEDBERG, K. OLOV. University of Uppsala. *The Phytogeographical Position of the Afroalpine Flora.* On the upper parts of the isolated high mountains in tropical East Africa prevails a peculiar flora with a pronouncedly discontinuous distribution. This "afroalpine" flora, characterized by giant senecios, giant lobelias, shrubby alchemillas, etc., differs so much from the flora of lower levels in the same region, and from other mountain floras, as to merit the rank of an independent floristic region. Its high proportion of endemics — about 80 per cent of the species, and four genera of 105, plus one subgenus — indicates a lengthy isolation. The high incidence of geographically vicarious taxa suggests that the afroalpine biotas of different mountains have long been effectively isolated from each other. Some remarkable life forms, peculiarly adapted to the afroalpine climate, are evidently older than the differentiation between the present afroalpine enclaves. The relatively low frequency of polyploids intimates that the later history of the afroalpine flora has been free from major revolutions. Outside tropical Africa, some seven non-endemic afroalpine species have a boreal distribution, four are Mediterranean, two Himalayan, seven South African, and five extend to temperate latitudes on both hemispheres. The affinities of the endemic taxa follow much the same pattern. The afroalpine flora must, therefore, be of complex derivation and have existed in tropical Africa for considerable time, perhaps since the Miocene.

HEENEY, H. B., and H. HILL. Plant Research Institute, Canada Department of Agriculture. *The Use of Foliage Analyses to Determine Fertilizer Requirements in Apple Orchards and for Some Vegetable Crops.* Results are presented of a study in thirty-nine orchards in the apple-growing districts of southwestern Quebec in which foliage analyses are used as a basis for orchard fertilizer recommendation. Standard levels of foliage content established previously in other orchard areas were confirmed. Using these standard levels, changes were recommended in fertilizer applications in the four-year period, 1953 to 1956. During this period corrections of both deficiency and toxicity conditions were made. Orchard management factors affecting the simple foliage nutrient level–fertilizer requirement relationship in apple orchards are discussed. The value and limitations of foliage analytical data in making fertilizer recommendations for annual crops are discussed. A method of applying a modification of the Mitscherlich Law of Diminishing Returns based on a percentage yield concept is demonstrated and the possible application of such procedures to organic soil crop production discussed.

HEGNAUER, ROBERT. Farmaceutisch Laboratorium, Rijksuniversiteit, Leiden, Netherlands. *Die systematische Bedeutung des Merkmales der Cyanogenese.* Im Pflanzenreich gibt es biogenetisch, physiologisch und formalchemisch verschiedene Typen der Cyanogenese. Für taxonomische Erwägungen sollte man nach Möglichkeit den Typus der Cyanogenese und nicht bloss die Tatsache des Blausäurevorkommens berücksichtigen. Bis heute sind aber leider erst zwei Haupttypen der Cyanogenese in Einzelheiten bekannt. Die Verbreitung des Merkmales der Cyanogenese wird geschildert und dabei nur Vorkommnisse durch Literatur belegt, die in den Listen von Rosenthaler (1919, 1929) nicht erwähnt sind. In jeder Sippe werden der Typus der Cyanogenese sowie die für taxonomische Betrachtungen wichtigen biologischen Beobachtungen kurz besprochen. Abschliessend werden die folgenden vorläufigen Schlussfolgerungen zur Diskussion gestellt: (1) Wegen der fast allgemeinen Verbreitung von Spuren von Blausäure im Pflanzenreich sollte man als eigentliche Blausäurepflanzen nur solche betrachten, die bei den üblichen Schnelltestverfahren positive Resultate geben. (2) Bis zum Range der Familien ist das Merkmal der Cyanogenese in vielen Fällen taxonomisch wertvoll (Charakterisierung von Agrotypen und Cultivars von Zierpflanzen; Umgrenzung von Arten, Genera und Familien). (3) Für weiterreichende systematisch-phylogenetische Schlüsse, wie sie etwa Hallier (1913) vorschwebten, erscheint das Merkmal wenig geeignet, denn es ist sehr alt und findet sich zum Teil in unveränderter Form von den Pteridophyten bis zu den *Asterales.* Die Fähigkeit Blausäure zu bilden und in irgend welcher Form in der Zelle festzulegen, erscheint als eine dem Pflanzenreich allgemein eigene Potenz. Diese Potenz wird aber nur selten verwirklicht wenn wir als Kriterium der Realisation die Akkumulation cyanogener Verbindungen nehmen. Die Zahl der echten Blausäurepflanzen unter den Cormophyten beträgt nur ca. 3%.

HEIM, ROGER. Muséum National d'Histoire Naturelle, Paris. *Les Champignons hallucinogènes du Mexique.* C'est à R. E. Schultes, puis surtout à R. G. et V. P. Wasson, qu'on doit récemment la découverte de la persistance, dans le Mexique méridional, de cérémonies rituelles, d'origine précortésienne, dont le culte avait pour objet la vénération inspirée par des champignons sacrés au pouvoir divinatoire. Après avoir étudié les récoltes des Wasson, et entrepris la culture de ces champignons, appartenant aux genres *Psilocybe* et *Stropharia*, puis vérifié sur lui-même leurs effets hallucinogènes, déjà enregistrés par R. G. Wasson, R. Heim entreprit avec celui-ci une nouvelle expédition en 1956 dans les pays mazatèque, chatino et aztèque. Il put recueillir ou examiner 14 espèces de champignons hallucinatoires, utilisés par les Indiens, et cultiver à Paris 11 d'entre elles, la plupart de ces champignons étant nouveaux pour la science. A partir des obtentions sur composts, et d'une réalisation semi-industrielle de cette culture, vérifiant leur action au cours de nouvelles expériences, obtenant des variétés culturales à haut pouvoir en produit actif, il étend ces cultures, avec R. Cailleux, A. Brack, H. Kobel, à Paris et à Bâle, tandis qu'avec A. Hofmann la caractérisation des deux substances indoliques responsables, psilocybine et psilocine, est établie par chromatographie. Puis Hofmann en livre la formule développée, enfin en réalise la synthèse, montrant que la psilocybine donne la psilocine par déphosphorilisation. Les Laboratoires de Bâle (Sandoz) et de Paris (Muséum National) transmettent ensuite au J. Delay et à ses collaborateurs les corps actifs qui leur permettent une expérimentation systématique sur des sujets normaux et des malades mentaux, d'où il résulte que cette drogue pourrait offrir un intérêt dans le traitement de la schizophrénie. Ainsi, en cinq années de recherches, ce travail en équipe a abouti à mettre en lumière les aspects historique, ethnologique, archéologique, descriptif, cultural, physiologique, chimique, thérapeutique offerts par les champignons hallucinogènes mexicains. Le conférencier en résumera l'essentiel et présentera de nombreuses projections en couleurs, propres à ces divers chapitres, notamment aux cérémonies nocturnes des Indiens, aux Agarics sacrés, à leur culture.

HEIMBURGER, MARGARET. University of Toronto. *The Anemone virginiana-riparia-cylindrica Complex in Southern Ontario.* *A. virginiana* L. and *A. cylindrica* Gray are clearly separable by morphological differences, times of flowering, and contrasting habitat preferences. Plants more or less intermediate between these two species have been described as *A. riparia* Fern., but on the basis of present definition they are particularly difficult to distinguish from those of *A. virginiana.* In addition, plants are frequently found which are not easy to classify as belonging to any of these categories. Chromosome complements from root tips of plants from over fifty populations raised from seeds collected in the wild have been examined. All have sixteen chromosomes. When these are arranged according to increasing lengths, the first three pairs have subterminal constrictions, the fourth pair has submedian constrictions and arm ratios of 1:2, and the remaining four pairs have median or near median constrictions. In the karotype of *A. virginiana*, two pairs of chromosomes with subterminal constrictions have satellites on their short arms and the fifth pair of chromosomes is considerably larger than the fourth pair. The karotype of *A. cylindrica* differs in having only one pair of chromosomes with satellites and in the fourth and fifth pairs being nearly equal in size. In contrast, complements of plants referred to *A. riparia* are more diverse, some being intermediate, others approaching those of either *A. virginiana* or *A. cylindrica.* Detailed morphological studies of various members of the complex also reveal the variable nature of plants referred to *A. riparia.* In an attempt to trace the origins of these plants, hybrids between various taxa have been obtained. F_1 populations from some combinations appear to be completely sterile while others have only partially reduced fertility. Some characters such as the branching habit of *A. virginiana* and the style color of *A. cylindrica* are generally dominant while others such as leaf pattern show an intermediate type of inheritance. In addition to studies on morphology, chromosome behavior in meiosis of parents and offspring and inheritance in the F_2 are being investigated. The results from these various approaches in relation to the taxonomic status of *A. riparia* will be discussed.

HEIMSCH, CHARLES. Miami University, Oxford, Ohio. *A New Aspect of Cortical Development in Roots.* In the culture of excised roots of some tomato varieties, a pronounced diameter increase of the growing tip accompanies growth in length of the main axis. Anatomical study of the tips of roots cultured for one to seven days demonstrated that most diameter increase was attributable to an increase in cell number across the cortex. Considering the fact that cortical development involves repeated periclinal divisions of the innermost layer of cells in a centripetal pattern, increased width (in cell number) of the cortex results from a progressive increase in the number of periclinal divisions. Most roots showed an unequal distribution of the last periclinal divisions, there being at some levels more on radii opposite phloem strands than elsewhere around the central cylinder. Toward the tip from such levels cortical widening invariably extended around the central cylinder to a greater degree, in some cases around the xylem poles to complete a newly added cell layer. Similar relationships in the developing cortex were noted in root tips from potted tomato plants, and, according to the literature, perhaps in other species. From the viewpoint of functional relationships, periodic localization of cell divisions opposite phloem strands and then subsequent extension around the central cylinder are of particular interest.

HEISER, CHARLES B., Jr. Indiana University. *Natural Hybridization and Introgression with Particular Reference to Helianthus.* Natural hybridization has received increasing attention in recent years and the word introgression has been widely used. Introgression should not be employed, however, to describe hybridization in which gene flow is entirely localized. Of the 51 species of *Helianthus,* 23 are definitely known to be involved in hybridization. Of the remaining species only seven have been studied in enough detail to conclude that they do not hybridize with other species. The majority of the perennial diploids, some of which appear to be distantly related on morphological grounds, produce fertile F_1's and introgression is rather commonplace. Hybridization also occurs in the polyploid perennials, but the amount of introgression is difficult to assess since effects similar to introgression may result from allopolyploid segregation. The annuals in spite of producing rather sterile F_1's provide several examples of introgression. Primary and secondary speciation through hybridization may occur in *Helianthus,* but it is extremely difficult to provide absolute proof. The most obvious effect of hybridization is an enrichment of variability. Hybridization is certainly the greatest factor in making the genus a difficult one taxonomically.

HEJNOWICZ, A. *See* HEJNOWICZ, Z.

HEJNOWICZ, Z., and A. HEJNOWICZ. University of Wroclaw, Poland. *Variations of Length of Vessel Members and Fibres in the Trunk of Robinia pseudoacacia.* Measurements of the length of fibres and of vessel members in storeyed wood of *Robinia pseudoacacia* were made. There is a distinct change in fibre length within the growth ring; fibre length increases from the first-formed early wood to the late wood and drops abruptly at the ring boundary. The fibres of the first-formed early wood show no general tendency to increase in length from the pith outwards, but the fibres in other parts of wood show this tendency as clearly as fibres in non-storeyed woods. Adequately, the amplitude of variation in fibre length within the growth ring increases from the pith outwards. The length of vessel members is constant throughout a ring, but it increases slightly from the pith outwards. The cause of variation of fibre length is discussed. In non-storeyed wood, it is related to the change in the length of fusiform initials; in storeyed wood such as *Robinia*, it is due to an increasing degree of intrusive growth of the fibres during their differentiation. The fact that the variation may be attained in two different ways points to its adaptative character.

HELDER, R. J. University of Groningen, Netherlands. *Protoplasm Conditioning of the Medium and Absorption Capacity.* The absorption capacity of plant roots is largely dependent on the ionic composition of the media used prior to the absorption experiments proper. It is particularly the cations which have an influence on the subsequent absorption of both the cations and the anions. There is a striking resemblance with the effects of ions on entrance of solutes as found in classic studies on passive permeation. The ions present during the absorption experiment must have similar effects. They can determine the course of absorption of a particular ion.

HELLMERS, HENRY. California Institute of Technology. *Growth Responses of Coniferous Tree Species to Temperature. Pinus jeffreyi, Sequoia sempervirens,* and *Pseudotsuga menziesii* were studied using the temperature controlled, artificial light rooms of the Earhart Plant Research Laboratory. One-month-old seedlings were grown for an additional six months under various combinations of day and night temperatures and under 16-hour days of approximately 600 foot candles intensity. Jeffrey pine made its greatest total dry weight when it received 300 to 500° C. hours. This was independent of the day-night temperature combination between the extremes of a 26° C. day with a 4° C. night and a 10° C. day with a 23° C. night. Distribution of dry material between tops and roots was, however, affected by the day temperature. Tops increased and roots decreased in dry weight at a night temperature of 4° C. with increasing day temperatures above 17° C. and at a night temperature of 17° C. with increasing day temperatures above 10° C. Response of coast redwood was not related to total degree hours but rather to day temperature. Increased day temperatures caused increased growth. Highest day temperature used was 23° C. Douglas fir exhibited maximum growth at a 17° C. with both 7° C. and 23° C. night temperatures. This applied to both tops and roots.

HELMCKE, J.-G. Technische Universität Berlin. *Schalenmerkmale der Diatomeen.* Die Gestalt einer Diatomeenschale setzt sich aus vielen Einzelmerkmalen zusammen. Für die meisten der Merkmale müssen wir jeweils genetische Innenfaktoren annehmen. Die genetischen Faktoren bestimmen die Grenzen der Reaktionsnorm, in denen die Variabilität der Merkmalsausprägung durch nichtgenetische Faktoren verwirklicht wird. Die verschiedenen Merkmale sind nicht miteinander gekoppelt. Durch theoretische Kombination von nur wenigen Merkmalstypen wird bereits die grosse Formenfülle verständlich. Einige Merkmale sind formkonstant und daher vorwiegend genetisch bestimmt (z. B.

Kanalraphe), andere zeigen sehr weite Möglichkeiten zur Variabilität und sind vorwiegend statisch-dynamisch bestimmt (z. B. Anordnung der echten Kammerhohlräume). Die weitgehende Übereinstimmung zwischen Diatomeenschalen und künstlichen Schaumstrukturen gibt tiefe Einblicke in die kolloid-chemisch-physikalischen Voraussetzungen und Prozesse der Entstehung besonderer Schalenmerkmale. Die Schale wird als Abbild eines Augenblickszustandes der räumlichen Grenzphase des Zellprotoplasmas gedeutet. Chemische Vorstufen werden wahrscheinlich innerhalb des Protoplasmas (durch Fermente) an der Ausfällung zu Kieselsäureverbindungen gehindert. Auf der Grenze zu fermentfreien Medien kann jedoch die feste Schale ausfallen. Diese chemischen Voraussetzungen werden aber nur in bestimmten physiologischen Zuständen (meistens gleichzeitig mit Mengenzunahme des Protoplasmas) bestehen, da sonst ein (Gallert- oder Protoplasma-) Austritt durch Raphen usw. unmöglich wäre und die Poren verschlossen würden.

Henckel, P. A. Academy of Sciences, Moscow. *Drought Resistance of Plants and Methods of Increasing It.* The physiology of plant resistance is based on the presence of specific adaptive reactions. The specificity of plant reaction is based on the variety of the properties of the protoplasm and metabolism. The principal properties of protoplasm are more complicated than was supposed earlier. Such an important property of protoplasm as viscosity is found to be composite (structural and hydrophil viscosity). Drought resistance of plants is closely connected to and changes with the colloid-chemical state of protoplasm and metabolism. The ability of the plant to be dehydrated is dependent on the elasticity of protoplasm and on the possibility of maintaining synthetic ability during droughts. The ability to endure overheating is connected with the higher hydrophil viscosity of protoplasm, the increase of the contents of bound water, and the peculiarities of metabolism (respiration, fixation of ammonia by organic acids). One of the peculiarities of drought-resistant plants is their ability to maintain the synthetic ability of the root system at a higher level (nitrogen metabolism). Using the methods of adaptation of young plants (swelled seeds), it is possible to increase the drought resistance of plants (hardening of plants to drought before sowing). A single soaking and drying of seeds before sowing increases plant drought resistance. Thus, the elasticity and viscosity of protoplasm, the contents of bound water, the intensity of metabolism (respiration, photosynthesis, the enzyme activity and the higher amount of synthetic ability) are increased. Presowing hardened plants are more resistant to overheating and dehydration, endure drought better, and yield higher crops (under drought conditions). The heat resistance of plants may be increased by another method, by soaking swelled seeds in a 0.25 per cent calcium chloride solution. In this case, the metabolism and colloid-chemical properties of the protoplasm also change and lead to the increase of heat resistance.

Henderson, James H. M. Carver Foundation, Tuskegee Institute, Alabama. *An Interpretation of Growth Regulator Action as Demonstrated by the Phototropic Response in Avena Coleoptile.* Previous studies by Veldstra, Thimann, Hansch, and Muir, *et al.* have shown that the structure and spatial relations of certain growth regulators are essential to the action of these compounds. Recently Henderson and Turner speculated that the activity of a growth regulator depends upon its electronic nature and configuration rather than its functional or chemically constituted groups. Since there is very little evidence to support the electronic nature of a compound *per se*, other means were explored to indicate the influence of the change in electronic configuration or activity of the functional groups (e.g., degrees of ionization) on the response of the coleoptile. The method of analysis of growth-regulator activity used was the response of the *Avena* coleoptile to unilateral light: phototropism. The reason for the use of this method was based on two main factors: (1) previous work on the coleoptile with 2,4-dichlorophenoxyacetic acid and other growth regulators, and (2) the basic response of phototropism as a simple means of demonstrating reactions on the growth of cells. The results of several compounds in analogous series are given. The influence of pH, concentration, functional groups, etc., will be reported.

HENDRICKS, STERLING B. Mineral Nutrition Laboratory, U.S. Department of Agriculture. *Some Photo-reactions Controlling Plant Development.* Photoreactions controlling photo-periodic flowering responses, structural elongations as of stems, radicles, and leaves, seed and spore germination, anthocyanin synthesis, and many other plant responses are found from action spectra. The responses are controlled by the reversible oxidation and reduction of the photomorphogenic pigment, the two forms of which have absorption maxima in the red and far-red part of the spectrum. The responses to irradiances of the order of .01 J./cm.^{2} depend upon the action of the far-red absorbing form of the pigment as an enzyme. In those spectral regions in the red and the blue where both pigment forms adequately absorb radiation, the pigment system can be continuously excited and appreciable action produced by irradiances of the order of 1.0 J./cm.^{2} A portion of the excitation energy is used in reactions such as those involved in anthocyanin formation instead of the reversible change of the pigment. The rate of anthocyanin formation in apple skin and several seedlings is quantitatively calculated in various wave-length regions from the germination responses of lettuce seed and stem elongation of beans.

HENRY, ARTHUR W. University of Alberta. *Fungi and Root Diseases.* Root diseases due to fungi constitute a diverse group. They affect a wide variety of plants and are caused by many kinds of fungi. The soil environment exerts a particularly important influence on root-disease development, acting as it does both directly and indirectly. Its general effect on many fungal pathogens, invading the soil without the support of their hosts, is to cause their decline, probably in large measure through the activity of other members of the soil micropopulation. Unfortunately this action generally comes to a standstill in winter in much of Canada and partly in consequence of this the already complex fungal root-disease problem may be accentuated here. However, if full use is made during the growing season of the natural disease-control mechanisms of the soil, it should be possible to overcome this handicap. Through further study of the comparative physiology of plant pathogenic fungi and their competitors, ways and means of further encouraging the latter at the expense of the former may be found. To be of greatest value this must be achieved under field conditions.

HENRY, B. W. *See* JEWELL, P. F.

HEPTING, GEORGE H. U.S. Forest Service. *Forest Pathology in Forest Management in the United States.* Forest diseases in the United States cause a greater reduction in usable timber than do fire, insects, or any other destructive agents. Forest pathology in this country is characterized by diversity of causes and of tree species. We have major disease problems in every forest region, and our research is aimed largely at the more practical aspects of causes and control. Direct control is now practised against only a few forest diseases, including white pine blister rust, oak wilt, dwarf mistletoe, and nursery diseases. Important reductions in disease losses, particularly for heart rots, are being achieved largely through sound silviculture and by protection from fire and logging damage. The trend in disease research is to put much greater emphasis on the fundamentals of behavior of plants and pathogenes, in order to develop new concepts and to open up new approaches to solving disease problems. This new work will feature fungus physiology and genetics, mycorrhiza, host-parasite relations, the functioning of pathogene enzyme systems, soil organism interactions, and effects of fumigants on soil as well as on the diseases they are used against. Increasing emphasis will be given to problems involving the soil.

HERNANDEZ-XOLOCOTZI, EFRAIM. Escuela Nacional Agricultura, Mexico. *Distribution Patterns of some Mexican Grasses.* The known Mexican grass flora consists of 1,049 species in 160 genera; of these, 845 species are indigenous. Distribution patterns of 98 species, chosen for their importance to livestock production, indicate that four patterns are most common: (*a*) the mild, temperate, semi-arid and arid regions of north-central and northwestern Mexico (*Tridens grandiflorus, Scleropogon brevifolius, Muhlenbergia porteri, Hilaria mutica, Bouteloua eriopoda*); (*b*) the mild, temperate, sub-humid forested areas (*Bromus anomalus, Blepharoneuron tricholepis, Muhlenbergia macroura, Bouteloua radicosa*); (*c*) areas of extreme edaphic conditions, especially high alkaline content (*Distichlis spicata, Muhlenbergia repens, Bouteloua breviseta, B. chasei, B. karwinskii, Eragrostis obtusiflora*); and (*d*) ubiquitous (*Eragrostis neomexicana, Sporobolus poiretii, Aristida adscensionis, Bouteloua curtipendula, Heteropogon contortus*). Most species with northern extensions maintain similar patterns; some, such as *Buchloe dactyloides*, seem to be modified by invasion into tropical environments. Pattern (*a*) forms part of Axelrod's Mohavian Desert endemic center of xeric vegetation. Pattern (*d*) is characteristic of weedy species, some with extensive apomictic and polyploid populations.

HERVEY, ANNETTE. *See* ROBBINS, WILLIAM J.

HESLOP-HARRISON, J. Queen's University of Belfast. *Photoperiodic Effects on Sexuality, Breeding System and Seed Germinability in Rottboellia exaltata.* In the short-day grass, *Rottboellia exaltata*, pollen fertility is governed by photoperiodic experience. Following exposure from germination to days of 8 hrs. illumination, the three male flowers of the alicode are sterile, and pollen is produced only in the hermaphrodite flower, which is customarily self-pollinating. As the number of long days (14 hrs. or more illumination) interpolated before induction to flower in short days is increased, pollen production rises, until with 30 weeks or more of long days, all four flowers of the alicode are pollen fertile. Under these conditions, there is apparently a high level of outbreeding. The dispersal units, which consist of inflorescence segments, are structurally dissimilar in plants developing in photoperiodic regimes determining maximum and minimum pollen fertility. Moreover, the caryopses of plants grown in short days have but a brief after-ripening period, and are germinable in a wide range of conditions; those formed by plants receiving an appreciable number of long days early in life have a protracted after-ripening period, during which they germinate only in the presence of nitrate and in light intensities greater than 1,000 fc. Some of the implications of these observations will be discussed.

HESSELTINE, C. W. Northern Regional Research Laboratory, Peoria, Illinois. *The Zygosporic Stage of the Genus Pirella (Mucoraceae).* Five isolates of the genus *Pirella* have been studied, one from the Baarn Collection and four from California. It was found from mating studies that all strains were either + or —; consequently, the single species, *P. circinans*, is heterothallic. Zygospores, which are reported for the first time, are formed at 15° to about 20° C., but not at 7° or 24° C. In addition to a rather restricted temperature requirement for zygospore formation, specific media such as tomato-paste-oatmeal or potato-dextrose agars are required. Zygospores, formed within one week under the specified conditions, are produced aerially in the colonies from the surface of the medium up to the lids of petri dishes and are scattered over a broad area in a diffused fashion. The suspensors are equal in size, parallel to each other, and without appendages. The zygospore walls are black with blunt projections similar to those seen in *Mucor*. Because of the manner of zygospore development, the genus is an intermediate form between Mucor and the Thamnidiaceae, but because of the lack of sporangioles it is a member of the Mucoraceae.

HEWITT, W. B. *See* RASKI, D. J.

HEYES, J. K. University of Edinburgh. *Metabolic Aspects of Cell Growth.* Analysis of successive segments of seedling-pea roots for cellular constituents and various enzyme activities, when combined with a determination of cell numbers, enables cell growth and differentiation to be examined with respect to the changes in composition and metabolic activity of the average cell of such segments. Information on the changes in protein, ribonucleic acid (RNA) and deoxyribonucleic acid contents confirms that cell growth is not merely a process of inflation. Recent work has also confirmed that there is a progressive change in the composition of the protein during cell expansion. Analysis of the nucleic acid composition of cells in progressively advanced stages of development show the presence of two RNA fractions of differing composition, the relative proportions of which also change during cell development. Further experiments in which the composition of the RNA from various subcellular fractions of meristematic and mature cells has been obtained will be discussed.

HEYNE, E. G. *See* DUTTA, S. K., *et al.*

HEYWOOD, V. H., Liverpool University and *Flora Europaea* Research Project; and D. H. VALENTINE, Durham College, Durham, England. *The Flora Europaea Project: A Report of Progress.* Each flora presents particular problems to the writers. Those involved in Flora Europaea are caused by (1) the vast amount of data from some regions such as north and central Europe; (2) the paucity of information from much of the Mediterranean region (especially, the Iberian and Balkan Peninsulas); (3) the diverse traditions and criteria employed in the different countries; (4) the wealth of cytotaxonomic and "experimental" data which has been made available as the result of research during the past two decades. Over-all, no other continent has been so intensively studied floristically, yet it is salutary to remember that in attempting to summate this knowledge it is the widespread species which often present the greatest problems, due to the different and often conflicting treatment they have received in the various countries. The Flora Europaea project has devised special methods for dealing with these questions, including the submission of all manuscripts to a panel of regional advisers including representatives from nearly every European country. The first sets of manuscripts have already been circulated and a meeting of the editors and regional advisers was held in Vienna, in April 1959, to discuss the various practical problems which have arisen.

Highkin, Harry R. California Institute of Technology. *Photosynthetic Studies of a Barley Mutant Lacking Chlorophyll b.* A mutant of barley has already been described which lacks chlorophyll *b* (Highkin, 1950). The photosynthetic and respiratory rates of the mutant and the related normal barley with which it was compared were found to be identical when measured in white light using leaf sections, in a Warburg apparatus, or whole plant, measuring photosynthesis and respiration with an infrared gas analyzer. Emerson has reported a potentiating effect of low intensity blue light in the red action spectrum of chlorophyll *a*. It has been suggested that this potentiating effect is due to the transfer of energy from chlorophyll *b*. Experiments have been designed to test this hypothesis. Photosynthesis of the normal and mutant barley plants was measured in red, blue, and a combination of red plus blue radiation. It was found that blue radiation does in fact potentiate photosynthesis in the normal barley containing both chlorophylls, but has no effect on photosynthesis of the mutant lacking chlorophyll *b*. These experiments also indicate that chlorophyll *b* does not play a measurable role in the gas exchange of the plants.

Hilborn, M. T. *See* Farr, Wanda K.

Hilferty, Frank J. Massachusetts State Teachers College. *Studies on the Moss Flora of Massachusetts.* Field studies were made and the holdings of eight herbaria within the state examined. A total of three orders, 29 families, 46 genera, 236 species, and 16 varieties of mosses was collected or found in the herbaria. One additional family, 17 genera, 69 species, and six varieties have been reported as occurring in Massachusetts, but the writer has not been able to document these reports with herbarium specimens. From the standpoint of distribution by counties, the number of species and varieties seen or reported ranges from 13 in Dukes to 206 in Bristol. Some species, such as *Saelania glaucescens* (Hedw.) Broth., occur in only one county; whereas others, such as *Ceratodon purpureus* (Hedw.) Brid., are found in many counties. The paucity of records and herbarium specimens for many taxa and counties indicates the great need for more bryological field work in Massachusetts. Climatic and edaphic factors affecting the growth of mosses in this area are discussed.

Hill, H. *See* Heeney, H. B.

Hillis, Llewellya W. National Research Council at University of New Brunswick. *Structure and Taxonomy of Halimeda (Order Siphonales).* Characters important to the taxonomy of the genus *Halimeda* include various features of macroscopic and microscopic structure. Comprising the first are appearance, extent of development of the holdfast, morphology of the lowermost one to six segments, and the predominating shapes and sizes of the segments. The microscopic features include method and extent of development of the cortex, appearance of the inner cortical utricles, average diameter and degree of lateral attachment of the peripheral utricles, and behaviour of the nodal medullary filaments. The evaluation of these features in numerous specimens resulted in a revision of the genus. Twenty-one species were recognized, *H. orientalis* was placed in synonymy under *H. micronesica*, and *H. cylindracea* established as a species distinct from *H. monile*. Forma *hederacea* of *H. opuntia* was elevated to variety, f. *lata* transferred from *H. gracilis* to *H. lacunalis*, and the other varieties and forms placed in synonymy under the appropriate species. The priority of the species epithet *incrassata* over that of *tridens* was also established.

HILLMAN, WILLIAM S. Yale University. *Interactions of Chelating Agents and Photoperiod on the Flowering of Lemna perpusilla. Lemna perpusilla* strain 6746 grown in aseptic culture flowers as a typical short-day plant in media containing sufficiently high amounts of ethylene-diaminetetra-acetic acid or of numerous other chelating agents. In media not so supplemented it flowers irrespective of photoperiod except at somewhat higher temperatures (around 29°) where a short-day requirement is again observed. A temperature of approximately 31.5° prevents flowering entirely; this effect is exerted primarily on dark-period processes. All these results appear to be relatively specific for flowering, and are not general growth effects; they have been presented in detail elsewhere (W. S. Hillman, Am. J. Bot. *46:* 6, 7, in press, 1959). The fact that chelating agents can convert a day-neutral to a short-day plant suggests a close relationship between certain micronutrients and the photoperiodic control of flowering. Some interactions of chelating compounds and micronutrient levels under various conditions of temperature and photoperiod will be considered in an attempt to define this relationship more precisely.

HILLS, CLAUDE H. *See* POLLACK, ROBERT L.

HILLS, G. ANGUS. Ontario Department of Lands and Forests. *Comparison of Forest Ecosystems (Vegetation and Soil) in Different Climatic Zones.* A forest ecosystem is a dynamic biological productivity system in which the forest, as a group of organisms, utilizes the energy of its environment to produce matter. The total production possible from any specific locality is limited by (*a*) the potential energy of the combined macroclimate and landform features of the area, and (*b*) the degree to which vegetation throughout its succession is able to develop and utilize this potential. The actual production on any specific locality is governed by (*a*) the energy available from the soil in its present stage of development; (*b*) the energy available from the present ecoclimate condition; and (*c*) the ability of the vegetation present to utilize this present available energy. The present working basis for potential production is the best observed production from all localities which are classified as being of the same macroclimate-landform type. The objective of this paper is to demonstrate that within-site regions, based upon vegetation-environment interrelations, units defined in terms of the features of landform (relief, texture, structure, and petrography of parent soil materials) exercise a functional control on the development of vegetation and of soil and constitute the most logical base for classifying the forest ecosystem.

HIRES, CLARA S. Millburn, New Jersey. *Microscopic Illusions Analyzed: Tetrads, Spores, Ferns.* Spore studies should begin with whole living spores rather than with sections of fossils and old herbarium specimens to build correct concepts. Classification to survive must be based on actual three-dimensional structure, not effects. Shape variations are due to changes from their original tetrad form, limited in number by definite paths of development. Geometry can explain actual shape simply, and points out where spores can differ for classification purposes. Models indicate graphically actual variations that can be used in taxonomy. Photo-micrographs of the same spores, either in focal series or turning over, if compared with models, help clarify architecture and particularly details. Fewer simpler words are required to describe actual structure than are needed for the greater number of unstable two-dimensional effects. Many sectioned forms believed to represent different spore types are found in a single trilete model. Past work of others, based on two-dimensional effects, if combined can act as checks and prove valuable in three-dimensional terms. I am proposing here a system for spore classification based on actual three-dimensional structure, a new approach.

HIRONO, YOSHIHIKO. *See* IMAMURA, SHUN-ICHIRO, *et al.*

HIRSCHHORN, ELISA. Instituto de Patologia Vegetal, Argentina. *Abnormalities of Ustilago maydis from Cuzco, Peru.* A study was made of 300,000 chlamydospores and 426 monosporidial cultures of *Ustilago maydis* obtained from collections from three locations 3,100 meters above sea level in Cuzco. The chlamydospores from these collections germinated 10 to 15 hours later than normal ones, and 80 per cent of them produced deformed promycelia with or without septa, and abnormal hyaline to colored sporidia that resembled chlamydospores but had smooth exospores. A high proportion of these sporidia lysed or died. Some abnormal sporidia produced cultures with normal sporidia, and sub-cultures from normal sporidia gave rise to abnormal sporidia. About 10 per cent of the cultures grew slowly, only 3-4 mm. in three weeks, then suddenly changed to normal growth. Cultures from sporidia produced by chlamydospores that germinated normally produced abnormal sporidia. Abnormal sporidial types originated both during sexual and asexual reproduction, thus the abnormalities are not all attributable to one hereditary mechanism. The abnormalities were diminished in cultures grown on glucoside broth. Monosporidial cultures did not infect maize known to be susceptible to *U. maydis.* The peculiar cultural characteristics and abnormalities of *U. maydis* from Cuzco appear to be caused by a mutation, endemic and widely dispersed in the area.

HIRTH, LÉON. Institut Pasteur, Paris. *Multiplication du virus de la mosaïque du tabac en cultures de tissus.* La multiplication du virus de la mosaïque du tabac (V.M.T.) a été suivie au cours des diverses phases de la croissance de tissus accoutumés et de crown-gall de tabac cultivés *in vitro.* Les variations de la concentration en virus ont été exprimés en fonction de la teneur des cultures en protéines et en acides ribonucléiques. Un antagonisme entre la synthèse du virus et celle des acides ribonucléiques et des protéines a été mis en évidence. L'étude comparative de la multiplication du V.M.T. dans des disques de feuilles en survie et dans les cultures de tissus a permis de montrer que les mécanismes de cette multiplication devaient être différents dans les deux cas. Ramenée à la teneur en protéines, la concentration du V.M.T. dans les cultures de tissus est cinq à six fois moins grande que dans les feuilles. Par ailleurs, à concentration égale, le virus extrait des cultures de tissus est moins virulent que celui des feuilles. La microscopie électronique des deux types de virus est différente.

Ho, Pham Hoang. Faculté des Sciences, Saigon. *La Variation saisonnière de la végétation algologique de la côte rocheuse du Vietnam.* L'auteur étudie cette variation au cours de l'année. Les conditions de climat, de salinité et température de l'eau de mer sont examinées en vue de chercher la cause de cette variation. Les projections porteront sur l'étagement (zonation) de la végétation du littoral.

Hochster, R. M., and H. Katznelson. Microbiology Research Institute, Canada Department of Agriculture. *The Metabolism of Phytopathogenic Bacteria.* The paper will be introduced with a summary of existing knowledge regarding established metabolic pathways in phytopathogenic bacteria (excluding uronic acid metabolism). Interesting generic differences will be outlined as far as they are known. Recent work on the metabolism of *Xanthomonas phaseoli*, causal agent of common blight of beans, conducted by the authors and their colleagues will be described in more detail. This description will include the proposed mechanism of the cyclic regeneration of hexose-phosphate (not involving the pentose cycle), work on the functioning of the tricarboxylic acid and glyoxylate cycles, studies of key oxidase systems and of the effects of metabolic inhibitors on these, some aspects of energy metabolism from the point of view of adenosinetriphosphate degradation, and recent work on the phenomenon of oxidative phosphorylation as a possible clue to the energetics of phytopathogenicity.

Höeg, Ove Arbo. Oslo University. *Ethnobotanical Studies in Norway.* Up to a few generations ago, the wild flora played an important role in the life of the rural population in Norway. This importance is now on the decline, but a great deal of tradition is still to be found, together with a considerable wealth of plant names. Material in this field has been collected by Ivar Aasen (a small but important paper, 186?), Jens Homboe (several monographs about the ethnobotany of various species), Rolf Nordhagen (various important publications), Knut Faegri, and a few others. The present communication is based on a large material, including about 200,000 notes on plant names, collected from living sources during the last thirty years, from all parts of the country. Dot maps have been constructed, showing the various names for a number of species.

Höeg, Ove Arbo. Oslo University. *Stromatolitic Limestones from a Palaeobotanist's Point of View.* The name stromatolite was first published in 1918 by E. Kolakowsky, as the designation for calcareous bodies with a lamellated structure, found in the Buntsandstein (Triassic) of Germany. Kolakowsky was the first to describe them in detail and assume that they are of organic origin, the calcium carbonate having been precipitated through the activity of some unknown simple plants. Walcott (1914) described similar and other structures from the Precambrian, introducing a great number of new generic names, but without mentioning the word stromatolite. This word came into common use after Holtedahl's description (1918) of similar structures in the Arctic (Precambrian). Later, stromatolites were described from practically all periods and from many parts of the world. Pia did much to clear up the ideas concerning these bodies. It is, however, difficult to find anything quite similar to them in the process of formation in modern times although a great deal of work, carried out in the Bahamas and in Florida waters, has done much to throw light on their mode of formation. Typical stromatolitic limestone from the later part of the Quaternary occurs in some places in Norway and Sweden. They are now being reinvestigated. A radiocarbon dating has recently been carried out, but has to be repeated before publication.

HOENIGER, J. F. M., and D. F. FORWARD. University of Toronto. *Growth and Respiration in the Corn Root Tip.* Correlations between respiration and growth (as measured by increase in fresh weight) have been analyzed on the basis of concurrent rates of the two processes in corn root tips. A wide range of rates was achieved by manipulating external factors including oxygen supply, by the use of several metabolic inhibitors, and by following changes induced by the passage of time. Conditions for maximum efficacy of inhibitors were investigated and long-term experiments were found to be important in defining their action. The two processes, growth and respiration, responded similarly to manipulation of pH and nutrition. Essentially they were directly proportional in atmospheres with oxygen concentrations ranging from 5 to 100 per cent and in the presence of graded concentrations of malonate. Addition of certain other inhibitors produced a more complicated three-phase pattern of response which was quantitatively modified with time. The implications of the three-phase pattern will be discussed.

HOLLENBERG, GEORGE J. University of Redlands, California. *Smithora: A New and Interesting Genus in the Erythropeltidaceae.* The plant heretofore known as *Porphyra naiadum* Anderson is described as the type of a new genus *Smithora.* The manner of origin of spermatangia, not previously known, shows that the plant belongs in the Erythropeltidaceae rather than in the Bangiaceae. It differs markedly from other members of the family in the conspicuous "carpogonial" sori, which are released periodically as relatively large gelatinous masses. Numerous smaller marginal sori are often present also. The latter release spores (monospores?) more or less continuously. Culture studies concerning the development of these two types of reproductive structures have been undertaken during the past several summers. The results are as yet inconclusive.

HOLLIGER, HERBERT H. Huron, Ohio. *The Use of Polarized Light, Utilizing the Two-polarizer System, in Color Photography of Wet Cryptogamic Plants.* Photographs of many cryptogamic plants will show the best color contrast and color saturation if the picture is taken while the plant is very wet. Under this condition specularly reflected light from droplets of water or from glossy leaves is ruinous to good photographic composition and reproduction. These specular reflections may be completely eliminated by the use of polarized light, utilizing the two-polarizer system. In this system the first polarizing filter is placed in front of the light source. The second polarizer, rotated at 90° to the first one, is placed between the object being photographed and the lens. The specularly reflected portion of the light that strikes the object is still polarized and is blocked out by the second polarizer. The remainder of the light, reflected from the object being photographed, is diffusely reflected and is depolarized. The portion of this light that comes through the second polarizer is utilized to produce the photograph. With the specular reflections and glare removed the resultant photograph will show full color contrast and color saturation. The two-polarizer system results in an increase in exposure over ordinary photographic methods of 20 to 40 times.

HOLST, M. J. Canada Department of Northern Affairs and National Resources. *Experiments with Flower Promotion in Picea glauca (Moench) Voss and Pinus resinosa Ait.* Fertilizer shock, drought, and short-day treatments did not induce flowering in potted four- to six-year-old white spruce and red pine seedlings. Ten-year-old white spruce saplings which were root-pruned and fertilized at different dates during the growing season gave the following results. The control trees and those which were only fertilized did not flower; root-pruning and fertilizing in the early spring before growth started gave an average of 7, 78, 80, and 115 female flowers per plant when respectively 0, 50, 100, and 200 grams of ammonium nitrate were applied per plant; plants similarly treated in the middle of the growing season bore 0, 38, 20, and 92 female flowers per plant; the same treatments applied at the end of the growing season were not effective. The same series of treatments did not induce eight-year-old red pine to flower. Ammonium nitrate given to 14-year-old red pine in the middle of the growing season doubled flowering in comparison with the control; there were no significant differences of response to the doses which were 50, 100 and 200 grams per square meter. Old, overmature red pine increased flowering by 15 to 20 per cent in response to fertilizer application. A comparison of ringing, strangulation, and fertilization of 17-year-old red pine indicated that the fertilizer treatment was the most effective. Ringing of 70-year-old red pine was more effective when applied beneath the live crown than at the base of the tree. Co-dominant trees, which had not flowered previously, responded best to this treatment, while it reduced the number of flowers borne by dominant broad-crowned trees.

HOLST, M. J., and C. W. YEATMAN. Canada Department of Northern Affairs and National Resources. *A Provenance Study in Pinus banksiana Lamb.* A report is given on twelve Ontario provenances of jack pine (*Pinus banksiana* Lamb.) grown for eight years at the Petawawa Forest Experiment Station, Chalk River, Ontario. The areas of seed collection range from the head of the lakes, (latitude 50°N, longitude 90°W) to north-central Ontario (latitude 48°N, longitude 81°W) to Southern Ontario (latitude 46°N, longitude 78°W). Plant heights were measured in a nursery provenance experiment in the years 1953, 1954, and 1955, and in 1957 and 1958 in an experiment planted in the field. The relative heights of the provenances changed little during the period of study or between the two experiments, but the difference between the tallest and the shortest became more pronounced. In general, tree height was related to geographic origin. There was a trend for provenances from areas with longer growing seasons (southern and coastal) to be taller than those from areas with shorter growing seasons (northern and continental). The wide variation in height between provenances from the same climatic-geographic zone appears to be a reflection of the discontinuous distribution, typical for this intolerant species which is normally confined to infertile, dry, sandy soils.

HOLT, A. STANLEY. National Research Laboratories, Ottawa. *The Chemistry and Spectroscopy of Chlorophylls.* The double-bond stretching region (1,600–1,800 cm.$^{-1}$) of the infra-red absorption spectra of chlorophylls provides information concerning the cyclopentanone ring. The spectrum of chlorophyll *a* in non-polar solvents (CCl_4, CS_2) contains a strong band at about 1,645 cm.$^{-1}$ which cannot be assigned to a $C = O$ vibration. It has previously been designated as a "chelate" band resulting from enolization and hydrogen bonding of the β-keto ester. It is absent in the spectra of pheophytin *a* and chlorophyll *b* (I). Reduction of the C_3 aldehyde group of I to an alcohol group results in the reappearance of the 1,645 cm.$^{-1}$ band; removal of magnesium or further reduction of I to the 9-oxy-desoxo compound causes its disappearance. It occurs even more intensely in the spectrum of Mg-pyropheophorbide *a*-phytyl ester, and similarly disappears upon removal of magnesium or reduction to the 9-oxy-desoxo derivative. It apparently results from the $C = C$ group formed upon enolization of ring V. The effects of various functional groups and metals upon the presence or absence of this band and upon the visible absorption spectra will be described. Application of infra-red and visible absorption spectra to the identification of other pigments will be outlined.

HOOCK, JEAN. Institut Français d'Amérique Tropicale, Cayenne, Guyane Française. *Contribution à l'étude agrostologique des savanes sèches de la Guyane Française.* Recherches préliminaires: situation géographique de ces savanes, structure, sédimentologique et pédologique de leur sol. Composition de la flore, principales associations végétales et plantes indicatrices. Possibilités d'exploitation de ces savanes et esquisse d'une carte phytogéographique au 1/50.000e en vue de l'élevage. Etude agrostologique: mise au point d'une méthode de comptages, cycles annuels de la végétation dans les conditions actuelles (feux de brousse, pâturage libre) et en parcelles protégées. Etude de l'évolution de la végétation sous l'influence de ces deux actions, "Fire climax." Classification des différentes espèces suivant les cycles de végétation ainsi définis. Etude des cycles de végétation des mauvaises herbes, leur contrôle. Agrostologie appliquée: mise en route d'un pâturage tournant. Raisons du choix de cette technique d'élevage, structure des parcs, durées de rotation, charges à l'hectare. Analyse de l'expérience (1er juillet 1958—1er août 1959): évolution floristique du pâturage—herbes fourragères, mauvaises herbes, action des engrais; évolution du bétail: courbe des poids. Rentabilité, comparaison de cette technique d'élevage avec l'élevage semi-extensif: avantages et inconvénients des deux méthodes, conclusions.

HORIO, T., J. YAMASHITA, T. YAMANAKA, M. NOZAKI, and K. OKUNUKI. University of Osaka. *Terminal Electron Transport in Baker's Yeast.* Appleby and Morton succeeded in crystallization of yeast lactic dehydrogenase (containing cytochrome b_2 and flavin mononucleotide) from baker's yeast, which dehydrogenates lactate, then transfers the liberated electrons to cytochrome c via its cytochrome b_2-moiety. From the same source, we have crystallized cytochrome c, and cytochrome b_2 having no enzymic activity. As well as lactate the enzyme purified by the method of Bach *et al.* was found to dehydrogenate α-hydroxybutylate, L-glyceric acid (by Dickens), and malate, tartrate, reduced triphosphopyridine nucleotide, etc. (by us), varying in rate and in optimal pH. With the use of lactate and α-hydroxybutylate which are rapidly dehydrogenated, the enzyme is confirmed to dehydrogenate these substrates by its same dehydrogenase moiety (group specificity), and to transfer resulting electrons to its flavin- and cytochrome b_2-moiety, then to deliver to the cytochrome c externally added. Yeast lactic dehydrogenase can oxidize the substrates in the presence of phenazine methosulphate as well as in the presence of methylene blue. If treated at suitable conditions, the enzyme loses the lactate-methylene blue activity, while it maintains the lactate-phenazine methosulphate activity. Different from the native enzyme, the modified enzyme does not reduce the originally bound cytochrome b_2 in the presence of the substrate. Based upon these evidences, this report will be read with a special attention on some interrelationship between substrate-level dehydrogenation and cytochrome-level electron transport of yeast lactic dehydrogenase, compared with the cases of Singer *et al.'s* succinic dehydrogenase and Horecker *et al.'s* xanthine oxidase.

Howard, Richard A. Harvard University. *The Vascular Anatomy of the Petiole as a Taxonomic Character.* Metcalfe and Chalk in their monumental work, *Anatomy of the Dicotyledons,* suggest that further investigations of the vascular structure of the petiole may reveal patterns of diagnostic value in certain families and genera. A survey of three-dimensional petiole vascular patterns of woody plants has shown additional characteristics of taxonomic value in plant identification, of use in phylogenetic studies, and of value in understanding the growth and development of the leaf. The use of leaf position, presence or absence of stipules and their vascularization, nodal structure, number of traces and subsequent positional relationship of these in the petiole, plus accessory characteristics such as collenchyma, chlorenchyma, sclerenchyma, crystals, and pubescence allow the definition of a petiole type. A system of classification of petiole types is shown which allows identification of fertile or sterile material by family groupings, genera, or in some cases species.

Howe, Thomas D. College of Steubenville, Ohio. *Recent Studies of the Female Gametophyte in the Compositae, Especially in the Tribe Astereae.* In *Grindelia squarrosa* (Pursh) Dunal, the antipodal cells develop extensive haustoria extending laterally into the integument. Recent work has shown that similar lateral outgrowths occur in *Grindelia lanceolata* Nutt., *Haplopappus* (*Prionopsis*) *ciliatus* (Nutt.) DC., and *Gutierrezia* (*Amphiachris*) *dracunculoides* (DC.) Blake. They are absent in *Chrysopsis graminifolia* (Michx) Ell., *C. pilosa* Nutt., and *Heterotheca subaxilaris* (Lam.) Britt. & Rusby. This suggests a close relationship between the genus *Grindelia* and *Haplopappus ciliatus* and *Gutierrezia dracunculoides*; this is confirmed for the first two by the general similarity of the plants. Since *Erigeron philadelphicus* L. is the only species of the section *Euerigeron* in which the normal type of female gametophyte has been reported, it has been suggested that the original study might have been wrong. The present work, however, shows that the normal type is found in this species. The *Fritillaria* type of embryo sac is characteristic of the genus *Rudbeckia* proper (Tribe Heliantheae), while the normal type has been found in the segregate genus *Echinacea.* The *Fritillaria* type is now found in two species of another segregate genus: *Ratibida* (*Lepachys*) *columnifera* (Nutt.) Woot. & Standl. and *R. pinnata* (Vent.) Barnh. This indicates that *Rudbeckia* and *Ratibida* are more closely related than are *Rudbeckia* and *Echinacea.*

HOWELL, J. SHEILA. *See* KEYWORTH, W. G.

HOWLETT, FREEMAN S. Ohio State University. *Variation Patterns Established by Foliar Analysis of Vegetable Plants.* This paper deals with variations in the foliar composition of vegetable species and the relation of these variations to the nutritional status of such plants. For the purpose of analysis by spectroscopic and other means, selected leaves were removed from the plants of 15 species growing in plots receiving various fertilizer or mulch treatments on muck, greenhouse, and upland soils. The analyses included total nitrogen, phosphorus, potassium, sodium, calcium, magnesium, boron, manganese, iron, copper, and molybdenum. Data are presented to show the relationship of leaf composition to species and variety, stage of plant growth at time of sampling as well as location and maturity of leaves. Within a given plot or treatment, the various species frequently showed outstanding difference in composition in response to given nutrient elements. Furthermore, the variations in chemical composition with respect to stage of plant growth and location and maturity of leaves followed an apparent pattern. Granting that these variations complicate the problem of assigning critical nutrient concentration values to each nutrient element, evidence supports the conclusion that foliar analysis data, when expertly interpreted, are of outstanding value in assessing the nutritional status of each species.

HU, SHIU-YING. Harvard University. *The Taxonomy, Geography, and Economic Importance of the Genus Fraxinus in China.* Forty-six species of *Fraxinus* have been recorded from the flora of China in articles scattered in botanical literature. Some of the species do not even belong to the genus *Fraxinus*, while others do not actually occur in China. Confusion in the taxonomy and nomenclature calls for a revision of the genus for China. Consequently a new subgenus including five species with naked winter buds, entire leaflets, bracteate branches of the panicles, and very short filaments (one-fourth the length of the anther) is discovered from the tropical and subtropical regions of China. This subgenus is interpreted by the author as primitive among the subdivisions of the genus. A species of this primitive group extends its range southward to Sumatra. Two species from central and western China show close affinity with North American species. One other species from North China and one from Yunnan in southwestern China indicate close affinity to a European species. *Fraxinus chinensis* is extensively cultivated in China (1) for its valuable wood, (2) for its pliable twigs used in wickerwork, and (3) as a pasture for feeding a certain species of scale insect which secretes commercial candle wax.

HUBBELING, N. Institute for Phytopathological Research, Wageningen, Netherlands. *Inheritance and Interaction of Genes for Disease Resistance in Phaseolus vulgaris L.* Young seedlings of beans were tested artificially with alpha, beta, gamma, and delta races of *Colletotrichum lindemuthianum.* In segregating populations, about eight dominant genes in allelomorphic series appeared to be involved. With regard to this inheritance, consecutive tests during some three or four generations are necessary. In the white-seeded selections obtained, no linkage with genes for resistance to other diseases was observed. About eight genes with recessive inheritance for resistance to halo blight, common and yellow bean mosaic, and stipple streak are required. Therefore, in the seedling stage, a combined test is not possible as a rule. Nevertheless, in the first segregating populations, seedlings, which proved to be resistant to anthracnose, were inoculated with virus of common and yellow bean mosaic. Thus the reactions of virus susceptible plants could be observed, without preventing them from producing some seeds, which contain genes for resistance. In further progenies plants with an increasing number of these genes were selected and consequently the resistance to stipple streak and halo blight could be secured too. Finally, in order to incorporate all other desired characters, many combinations and recombinations among plants with multiple resistance had to be made.

HUEBER, F. M. *See* BANKS, HARLAN P., *et al.*

HUECK, KURT. UNO-FAO Instituto Forestal, Merida, Venezuela. *The Present State of Vegetation Mapping in Venezuela.* The history of vegetation mapping in Venezuela will be reviewed with reference to H. Pittier, T. Lasser, V. Vareschi, and F. Tamayo. The new map prepared in the Latin American Forest Institute in Merida will be presented. Some special Venezuelan problems concerning the area of the rain forest and the area and origin of the Venezuelan savannas will be discussed.

HUGHES, N. F. Sedgwick Museum, Cambridge, England. *A Search for Angiosperm Pollen in Lower Cretaceous Rocks.* Results are given from a large number of rock samples from the Lower Cretaceous of England (Berriasian to Aptian/Albian) which have been prepared for palynological study and searched for pollen with angiospermid characters of any kind. The genera *Eucommiidites* (Erdtman) and *Clavatipollenites* Couper, and other new forms are described in detail, and their distribution discussed. While it is realized that information from dispersed pollen grains has only a limited application, it is suggested that integration of this material into palaeobotanical accounts is an urgent problem which cannot await precise decision on the affinities of all these newly discovered fossils.

HULME, A. C. Ditton Laboratory, Larkfield, England. *Chairman's Address to Symposium on the Physiology of the Maturing Fruit.* Following general opening remarks concerned with the symposium as a whole, a brief summary will be given of the progress of maturity in certain fruits in terms of their volatile emanations.

HUMPHREYS, T. E. *See* DUGGER, W. MACK

HUNZIKER, JUAN HECTOR. University of California. *The Origin of Agropyron scabriglume.* *Agropyron scabriglume* is a hexaploid species ($2n = 42$) of Northwestern Argentina. The artificial hybrid ($2n = 35$) between an undescribed tetraploid species ($2n = 28$) from Tilcara, Jujuy, Argentina (which will be referred to as *A.* "Tilcara"), and *A. scabriglume* had the following mean number of trivalents, bivalents, and univalents per cell: 0.43 III, 13.45 II, 6.80 I (93 cells); while *A.* "Tilcara" had 13.96 II and 0.06 I (145 cells). The mean number of closed bivalents in the hybrid and in *A.* "Tilcara" was 12.64; the modes, 13 and 12, respectively. Pollen and seed fertility in the hybrid was 46.5 per cent and 30.5 per cent, respectively. The agreement between mean numbers of bivalents and closed bivalents in the hybrid and in *A.* "Tilcara", together with certain morphological resemblances between the two species, suggests that probably *A.* "Tilcara", or a species very closely related to it, is the tetraploid parental species of the hexaploid *A. scabriglume.* Because of certain *Hordeum*-like morphological characteristics of *A. scabriglume,* it is postulated that the other parental species might have been a diploid *Hordeum.*

HURD, R. G. *See* SUTCLIFFE, J. F.

HUTCHINGS, SELAR S., and MEREDITH J. MORRIS. U.S. Forest Service. *Use of Distance Measurements for Determining Plant Density in Semidesert Vegetation.* To evaluate merits of the "nearest neighbor," "closest individual," and "point-centered quarter" methods in measuring density and spatial distribution of plants, distance measurements by these methods were compared with plant counts on 33 stands of small desert shrubs in western Utah. Included were pure stands of *Eurotia lanata* (Pursh) Moq. and *Artemisia nova* A. Nels., and mixed stands of these species with *Chrysothamnus stenophyllus* (A. Gray) Greene and/or *Atriplex confertifolia* (Torr. and Frem.) S. Wats. Stands varied widely in number, age, and size of plants. Plants in pure stands were essentially randomly distributed as shown by chi-square tests of expected and observed frequency distributions of distances. Only randomly dispersed stands showed close agreement between methods. In mixed stands individual species often were strongly contagious, but all species combined were randomly dispersed. The ratio, observed/expected mean distance, provides a useful index of plant distribution. This function is asymmetrical: upper limit, infinity; lower limit, approximating 0.75. Index of 1.00 is expected in random populations; lower values indicate regular distribution; higher values indicate contagion. Index values for individual species in stands studied ranged from 0.94 to 3.01. Populations having values between 0.95 and 1.22 were essentially random.

HUTCHINS, LEE M. Inter-American Institute of Agricultural Sciences, Turrialba, Costa Rica. *Cushion Gall of Cacao.* First reports of cushion gall, or "buba," of cacao came from Colombia during 1938–40. Recent surveys discovered the gall to be sparsely distributed over much of tropical America, and epidemic in parts of Nicaragua, Costa Rica, and Colombia. It was reported authoritatively in 1954 from a limited area in Ceylon. Symptoms are recognized only in flower cushions where semi-hard, verrucose galls up to a few inches in diameter and bearing great numbers of floral initials or buds are formed. In one type, most of the buds remain sessile; in another type they elongate and open. Both types are unfruitful. In a planting 8 years old in Costa Rica, 90 per cent of the trees developed cushion gall in 1958. In a heavily diseased planting of older trees, 2,000 galled cushions were counted on one tree; this tree bore no seed pods. Circumstantial evidence points to distribution through infected propagating material. It is important to select such material in areas free of the disease. Apparently resistant clones have been found. Eventual development of control through resistant sorts looks promising.

HYUN, S. K. Seoul National University. *Problems in Seed Orchard Establishment.* Establishment of clonal seed orchards by interplanting selected phenotypically superior clones within the species constitutes a vital aspect of the world's forest tree breeding program. However, the establishment of a hybrid seed orchard by interplanting selected parental species for the production of heterotic F_1 hybrid seed also forms an important feature. Thus, in Korea, great emphasis is being placed upon the establishment of F_1 hybrid seed orchards of *Pinus rigida* × *P. taeda* in the light of its great economical potentialities. In establishing such hybrid seed orchards, the following constitute the principal problems. (1) Choice of the origin of pollen parent. Because of the effect of geographical races of parents on the performance of hybrid progeny, the importance of choice of the geographic origin of pollen parent is indicated. (2) Synchronizing of flowering of both parents. The flowering habits of pine relative to physiological, ecological, and genetic factors having been described, the possibilities of taking advantage of these habits for synchronizing of flowering of both parents are discussed. (3) Emasculation of seed trees. In the light of fairly high individual variation in self-sterility of pitch pine, employment of a self-sterile clone as a seed parent is indicated as a means of physiological emasculation. Chemical induction of male sterility is also suggested. (4) Reduction of diversity and promotion of superiority in hybrid progeny. For reducing phenotypic diversity as well as promoting genotypic superiority of hybrid progeny, composing a seed orchard with the seed parent represented by one highly selected clone and the pollen parent by several highly selected clones is suggested. (5) Promotion of fertile seed production. Because of the close relation between the number of fertile seeds per cone and the availability of pollen, the importance of arranging pollen parents in hybrid seed orchards so as to provide an abundant pollen supply to each seed tree is advocated. (6) Flowering stimulation. In consideration of the disturbance of flowering behavior of exotic species due to the alteration of their habitat as well as the annual variation of flowering and cone production, it is proposed that some means of controlling these phenomena should be devised. (7) Pruning and shaping. The type of pruning in relation to floral primordia formation and cone bearing is being tested in order to find out the type of pruning and shaping favorable for seed parent and for pollen parent respectively.

IKEDA, Y. University of Tokyo. *Potential Application of Parasexuality.* Potential application of parasexuality in fungi was studied with an industrial strain of *Aspergillus oryzae.* The strain is used for the digestion of soy bean protein in a soy sauce company in Japan, and has no orthodox sexual cycle. A heterocaryon between a mutant producing protease in an earlier stage of growth and a mutant producing the enzyme in a later stage produced protease far beyond the production limit of each strain and the original strain. This effect may be due to a kind of heterosis. The diploid, triploid, and tetraploid strains derived from a different combination of mutants were also high producers of protease. A few interspecific hybrids were produced between *Asp. oryzae* and *Asp. sojae,* but, as a matter of fact, they were not improved strains with regard to protease production. Though the attempt to isolate an improved strain among the segregants of the above-mentioned diploids has not yet been worked out, an improved strain with regard to kojic acid production was successfully selected when a kojic acid producer and a non-producer were employed as the starting strains.

IMAI, SANSHI. Yokohama National University. *Basidiomycetes of Japan.* I will report on the Japanese Basidiomycetes in relation to those of North America and of Europe, dealing mostly with the distribution of species in the north temperate zone, taking Polyporaceae and Clavariaceae as examples. Despite its limited area, Japan abounds in species of these families, having almost as many as Europe or North America. Japan and North America have more species in common than Japan and Europe have. A considerable number of species are also distributed in tropic Asia. These data clearly indicate the existence of an equivalent geographic relationship between the fungus floras of Japan and those of North America, mostly of eastern North America, as pointed out by Asa Gray in the vascular floras. The studies of geographical distribution and the morphological relations of existing species provide the best possible aid for the phylogenetic assumptions about fungi, though one must be warned against the danger of basing phylogenetic assumptions only on these studies. The studies of Basidiomycetes of Japan and of eastern Asia may have the most important bearing upon the explanation of the history and phylogeny of the Basidiomycetes.

IMAMURA, SHUN-ICHIRO. Kyoto University. *The Nature of Inhibition of Flowering by the Leaves Illuminated Continuously during the Inductive Dark Treatment of Other Leaves in Short-day Plants.* Light given to one part of a short-day plant, while the other part is subjected to an inductive dark period, inhibits the flowering response more or less. This inhibition may be caused by various mechanisms. There exist the following four possibilities. (1) The leaf in the light plays the role of a "sink" of photoperiodic stimulus. (2) The growing point is nourished by substances supplied by leaves both in the light and in the dark. The intensity of the photoperiodic stimulus may be "diluted" by assimilates coming from the illuminated leaves. (3) The translocation of the photoperiodic stimulus may be affected by the illuminated leaf. (4) A reaction or reactions leading to the production of an inhibitory stimulus may take place in the illuminated leaf. These possibilities will be discussed on the basis of experimental observations with *Pharbitis* and *Xanthium.*

IMAMURA, SHUN-ICHIRO, YUKIYOSHI OGAWA, and YOSHIHIKO HIRONO. Kyoto University, Japan. *Effects of Gibberellin and Gibberellin-like Substances on a Dwarf Strain of Pharbitis nil Chois.* A dwarf strain of *Pharbitis nil* called "Kitachi" is strongly affected by external application of gibberellin and assumes the appearance of the normal strain, whereas it does not react to β-indoleacetic acid. When applied to the plumula of the seedlings, the growth of hypocotyl, cotyledonary petioles, and main axis is accelerated. The elongation of the first two organs is due to cell elongation and that of the last one mainly to cell division; 0.02 γ or less per plant can result in a statistically significant elongation of the main axis. Thus, the seedlings of this plant can be used as a test plant for bioassay of gibberellin and gibberellin-like substances extracted from plant materials. As in many long-day plants, both gibberellin and gibberellin-like substances can promote the initiation of flower primordia in *Pharbitis nil,* a short-day plant. The distribution of gibberellin-like substances in various plant organs and their chemical properties as compared with gibberellin are reported.

IRVINE, DAVID E. G., and PAUL C. SILVA. University of Illinois. *Preparation of an Index Nominum Algarum and Bibliographia Phycologica Universalis.* The general background of this project has been outlined in Taxon 7(8): 251 (1958).

This paper is an attempt to outline the scope of the works as currently envisaged, the type of information being collected, and our system of compilation. We welcome criticisms and suggestions, and in turn have some to offer writers and editors, in the light of our bibliographic experience. The *Index Nominum Algarum* is intended to include all effectively published names of algal taxa, irrespective of the rank of a taxon and the validity and legitimacy of the name. Flagellates and charophytes will be indexed in addition to the incontrovertibly algal groups; fossil algae will be included. Author, place and date of publication, rank and validity of publication will be indicated. Basionyms for new combinations and the language of diagnosis for new taxa will be given. The *Bibliographia Phycologica Universalis* is designed to list alphabetically by author all published works giving algal information of possible scientific interest, including books, monographs, notes, reviews, and abstracts. Titles will be given in the original language, together with an English translation for those titles in languages other than Latin, French, German, Italian, or Spanish. A subject index will be provided.

Isaac, P. K. University of Manitoba. *Growth Analysis of Filamentous Fungi.* Tests of the standard methods of measuring growth in fungi reveal that they are unsuitable, in several respects, for the comparison of the growth of different species. A system of analysis of the filamentous growth of fungi will be demonstrated, and it is suggested that it provides a valid basis upon which a comparison of the responses of different fungi to environmental factors may be made. At the same time the results provide information on the organization of the mycelium during the colonizing phase of growth.

Ishida, Kiichi, and A. Sato. University of Tokyo. *Isolation of Cryptococcus neoformans from Pigeon Droppings in Japan.* A frequent association of *Cryptococcus neoformans* with pigeon manure was reported by Emmons in 1955. The present authors observed a case of pulmonary cryptococcosis in a cat in 1957 and the organism was isolated from the lesion. At that time, a special interest had been aroused in our mind as to whether this curious relationship between *Cryptococcus neoformans* and pigeon manure might exist also in Japan. A small survey on the pigeon droppings and manures was carried out during and following the spring of 1957. Twenty-four specimens of pigeon droppings were collected from five places in Tokyo and three specimens from Kyoto. Another ten specimens were collected from carrier pigeon houses of two press companies in Tokyo. The isolation procedures were carried out following Emmons' method. *Cryptococcus neoformans* was isolated from 28 of 37 specimens of pigeon droppings collected. One or more specimens were positive from each of the places from which specimens were collected. As a control, eight specimens of bird manure other than pigeons' were collected and *Cryptococcus neoformans* was isolated from one specimen of skylark. The identification of the isolates was based on the morphological characteristics, biological properties, and pathogenicity for mice.

Islam, A. S. Sind University, Hyderabad. *Crossing Relationships in the Genus Corchorus.* The genomes of *Corchorus olitorius* L. and *C. capsularis* L. (the two jute fibre yielding species), which cannot be directly crossed to yield fertile hybrids, may be combined through *C. depressus* Stocks (=*C. antichorus*

Raeusch) because each of the cultivated species, *C. olitorius* and *C. capsularis*, were found to produce fertile promising hybrids when crossed with *C. depressus*. In both *C. olitorius* × *C. depressus* and *C. capsularis* × *C. depressus*, crosses were successful when *C. depressus* was used as the female parent. In the reciprocal cross the fruits set but contained no viable seeds. The cross between (*C. olitorius* × *C. depressus*) and *C. capsularis* and the reciprocal yielded fruits with apparently viable seeds. Crosses were successful between *C. olitorius* and a new species of *Corchorus* found by the author growing in Sind, West Pakistan. The results of crosses indicate that *C. olitorius* is closely related to *C. depressus* and *C. sp. nov.*, but not to *C. aestuans* Ham. (=*C. acutangulus* Iam.), *C. trilocularis* L., *C. capsularis* L., *C. fascicularis* Iam., and a natural tetraploid *C. siliquosus* L. with $2n=28$. In the cross *C. aestuans* × *C. olitorius*, fruits set when the former was used as the female parent, but no success was obtained in the reciprocal. In the cross *C. olitorius* × *C. capsularis*, the fruits set with no viable seeds in both directions, but in the combination in which *C. capsularis* was the female parent the application of hormone on the pedicel of pollinated flowers was necessary. When the c-tetraploid strains of these two species were crossed, they did not show any change in their crossing relationship except that there were larger numbers of fruit set in either direction.

JACOBS, WILLIAM P. Princeton University. *Auxin as a Limiting Factor in the Differentiation of Plant Tissue.* A particularly extensive and quantitative amount of evidence has been collected in the last ten years that auxin is the internal factor in *Coleus* plants which is normally limiting the differentiation of xylem cells, both in normal differentiation and in regeneration. Fifteen times as much auxin is required to make a single regenerated xylem cell as to make a normal one. Available evidence supports the interpretation that auxin also limits xylem differentiation in other plants and other organs.

JACOBS, WILLIAM P. Princeton University. *A New Type of Evidence that Auxin Does Not Normally Control Apical Dominance.* Adult plants of *Coleus blumei*, growing vigorously in greenhouse culture, show apical dominance with respect to the younger side-buds. Quantitative investigations, involving exact replacement of the native auxin coming from the top of the plant by the same amount of synthetic auxin, confirmed the expectation from our earlier work on compensatory growth that auxin is not the factor controlling apical dominance in *Coleus*. This conclusion is the opposite of the classical explanation, which was based on inexact matching of added auxin on seedling plants of various legumes. It is not yet possible to say whether the difference in conclusions as to the factor normally controlling apical dominance is due to inexact matching in the earlier papers, or to a general difference between seedlings and adult plants. But since matching auxin has no inhibiting effect in a clonal stock which has been shown previously to have simple, quantitative relations between auxin and abscission and xylem regeneration, it is clear that the classical explanation does not hold generally.

JACQUES-FELIX, HENRI. Office de la Recherche Scientifique et Technique Outre Mer, Paris. *Les Gramineae d'Afrique tropicale dans la classification.* J'ai montré ailleurs (J. Aric. trop. Bot. appl., 1958) que les caractères d'anatomie foliaire sur lesquels on s'est basé pour la distinction des groupes supérieurs des

Gramineae étaient d'origine mésologique et que les deux sous-familles des Festucoïdeae et des Panicoïdeae ainsi créées étaient polyphylétiques. Les tribus ont eu, en général, une évolution écologique suffisamment localisée pour avoir une structure relativement homogène et le critère anatomique est très utile à leur définition. J'ai appelé "écophylétique" ces caractères forgés par le milieu et présentés par certains phyla. Leur répartition en deux seul grands groupes est insuffisante et il devient une simple vue de l'esprit de qualifier d'anatomiquement hétérogènes des taxa qui ont à la fois des caractères "festucoïdes" et "panicoïdes." W. V. Brown, le plus récent auteur à se référer à l'anatomie, est amené à reconnaître jusqu'à six types distincts (Bot. Gaz., 1958). Faisant essentiellement appel aux caractères fondamentaux de la fleur, de l'embryon et de l'épillet, puis à ceux de l'histologie et anatomie foliaires, j'aboutis, pour les Gramineae d'Afrique, à dix séries dont quelques-unes sont monotribales. En ce qui concerne l'embryon j'écarte le caractère de la première feuille qui est, lui aussi, de nature écophylétique et qui disperse les brillants résultats obtenus par J. R. Reeder sur cette question. (Am.J.Bot., 1957). I, Série olyroïde: (1) Olyreae, (2) Phareae; II, Série bambusoïde: (3) Bambuseae, (4) Arundinarieae, (5) Atractocarpeae; III, Série streptogynoïde: (6) Streptogynae; IV, Série oryzoïde: (7) Oryzeae, (8) Ehrharteae (cette tribu a un embron aberrant dans la série), (9) Phalarideae; V, Série zizanioïde (Zizanieae — cette tribu n'existe pas en Afrique), (10) Phyllorachieae; VI, Série centothecoïde: (11) Centotheceae; VII, Série arundinoïde: (12) Arundineae, (13) Elytrophoreae, (14) Danthonieae, (15) Thysanolaeneae, (16) Arundinelleae, (17) Aristideae; VIII, Série festucoïde: (18) Festuceae, (19) Hordeeae (+ Monermeae), (20) Agrosteae (Aveneae incluses), (21) Stipeae; IX, Série chloridoïde: (22) Eragrosteae, (23) Pappophoreae, (24) Chlorideae, (25) Spartineae, (26) Leptureae, (27) Sporoboleae, (28) Zoysieae; X, Série panicoïde: (29) Paniceae, (30) Isachneae, (31) Andropogoneae, (32) Maydeae.

Jaeger, Paul. Université de Strasbourg. *Etude sur la végétation des plateaux gréseux de la Boucle du Niger (Afrique Occidentale).* Les plateaux gréseux dont nous avons étudié la flore et la végétation s'étirent en direction SW-NE depuis la région de Mopti jusqu'à Hombori en passant par Bandiagara, Sanga et Douentza. Notre attention fut tout spécialement attirée par la flore résiduelle et à cet effet nous avons exploré de préférence, les stations maintenues intactes: ravins, éboulis, hauts-plateaux, etc. Dans des ravins encaissés situés par 15°12′ (Kikara) dans un paysage typiquement sahélien nous signalons: *Cola laurifolia, Aphania senegalensis, Saba senegalensis, Ficus becardii, Sanseviera* sp., *Pyrocarpus americanus.* Des hauts-plateaux (1000 m.) sont caractérisés par une végétation ouverte à *Sarcostemma viminale, Cissus quadrangularis, Tephrosia mossiensis, Senecio cliffordianus.*

Jaffe, Lionel F. Brandeis University, Massachusetts. *The Dependence of Growth in Phycomyces on the Polarization of Incident Light.* It will be shown that the average intensity of light within a transparent cylinder perpendicularly illuminated from the outside is independent of the reflective powers of the cylinder's surface. Light lost by external reflection is always precisely compensated by light gained by internal reflection. This theorem is applied, with suitable corrections for deviations from transparency, to the phototropic and the light growth responses of *Phycomyces.* It will be shown thereby that the reflection

interpretation of the polarization dependence of these phenomena is incorrect. An alternative interpretation based upon the orientation of pleiochroic photoreceptors will be shown to be compatible with the available facts.

JAGENDORF, ANDRE T., and MAURICE MARGULIES. The Johns Hopkins University, Baltimore. *Analysis of Electron Transport Pathways and Inhibitor Sites in Isolated Chloroplasts.* The site of action of an inhibitor in the electron transport portion of photosynthesis may be localized by studying a series of reactions. These include: (*a*) the Hill reaction, in which an oxidant is reduced in substrate amounts and oxygen is evolved; (*b*) Arnon's cyclic phosphorylation where some oxidant (flavinmononucleotide, etc.) is alternately reduced and re-oxidized; and (*c*) the system of Vernon and Kamen in which a high potential electron donor is oxidized while some low potential oxidant is reduced. The last two systems eliminate steps involved in oxygen evolution proper. When various cofactors (oxidants) in Arnon's system and various components as electron donors in the Vernon-Kamen system are used, it appears that different regions of the oxygen evolution process are by-passed. If different oxidants are used, it appears that electrons are withdrawn at different points on the reducing side. Thus by studying the effects of one inhibitor on a series of these reactions, one may isolate several possibilities as to its site(s) of action. This analysis will be presented for the compound p-chlorophenyl dimethylurea.

JAIN, SUBODH K., and G. LEDYARD STEBBINS. University of California. *Patterns of Development of the Guard Cell Complex in the Epidermis of Monocotyledons.* In representatives of the families Alismataceae, Gramineae, Palmaceae, Araceae, Bromeliaceae, and Commelinaceae, four stages in development of the guard cell complex can be defined: (1) differentiation of the guard mother cell through an asymmetrical mitosis; (2) formation of subsidiary cells through asymmetrical mitoses oriented toward the guard mother cell; (3) division of the guard mother cell to form the two guard cells; (4) elongation and differentiation. The principal differences lie in the number of subsidiary cells formed, which are six to nine in Palmaceae, Araceae, and some Bromeliaceae, four in other Bromeliaceae and most Commelinaceae, and two in Alismataceae and Gramineae. During subsidiary cell formation the guard mother cell increases in size, and its nucleus becomes larger and more weakly staining by the Feulgen or aceto carmine method. In types with more than two subsidiary cells, division of the guard mother cell usually occurs before subsidiary cell formation is completed. The general pattern of development is remarkably constant throughout families, but minor fluctuations occur even in different parts of the same leaf. The bearing of these observations on current theories of development and differentiation, particularly those of C. H. Waddington and A. M. Turing, will be discussed. (This research was supported by National Science Foundation Grant no. G-3737.)

JENKINS, B. CHARLES. *See* TSUNEWAKI, KOICHIRO

JENSEN, WILLIAM A. University of California. *Cell Growth and Differentiation in Root Tips.* The general problem of cell development, particularly the early stages, can be approached through the study of the root tip. Modern cytochemical and histochemical techniques permit a close correlation of the morphological and physiological aspects of cell development and reveal an intricate picture of cell growth in root tips. The apical initials in a growing root appear to divide very little and represent a quiescent zone with respect to cell division. Behind this quiescent zone the cells begin a period of rapid radial enlargement and frequent cell division. This stage is apparently of great importance and terminates in the cells attaining final diameter and beginning to elongate. Cell divisions are most numerous in this transition stage and in early elongation. There are at least two distinct stages of cell elongation. The second stage is marked by the absence of cell divisions and the maximum rate of elongation. With all the stages of development, there are marked changes in amount and metabolism of the chemical constituents of the cell that can be correlated with the morphological changes. From such correlations, the outline of an integrated picture of cell development can be drawn.

JENSEN, WILLIAM A. University of California. *The Root Apical Meristem and Its Cellular Organization.* Studies using cyto- and histochemical techniques combined with morphological analysis of root tip confirm the existence in the normal growing root of a group of metabolically inactive cells. These cells are low in all cellular components so far studied and are very low in mitotic activity. Under normal conditions the number of cells in division increases markedly basal to this inactive region. The number of cell divisions reaches a peak in that region of the root where the cells are beginning elongation but drops markedly by the time the cells are in the period of maximal elongation. Most of the changes in cellular constituents so far measured can be correlated more precisely with changes in cell morphology rather than the distribution of cell divisions.

JENTYS-SZAFEROWA, J. Polish Academy of Sciences. *The Biometrical Method in Investigations of the Historical Evolution of Plants.* The author will show on the basis of graphs and photographs that using the biometrical method in investigation of historical evolution of plants one can solve not only morphological but also sometimes palaeobiological problems. The examples are taken from studies on the evolution of the genus *Carpinus* in Europe. After precise measurements of several thousands of recent and fossil fruits, the conclusion was reached that there had lived in Middle Europe, in the Pleistocene, the species *Carpinus betulus,* identical with the present one in shape and intraspecific variability. In the Pliocene there occurred a species with fruits similar to *Carpinus betulus*, but smaller. Among them, larger fruits identical with modern ones occurred sporadically. The form with larger fruits survived and is common today in Middle Europe. In the Miocene the same species occurred as in the Pliocene but as a form with narrow and acutely tipped fruits. Recent *Carpinus betulus*, on the southeast borders of its area, has the same form. This form is related to the warm and wet climate.

JEWELL, P. F., and B. W. HENRY. Southern Institute of Forest Genetics, Mississippi. *Breeding for Resistance to Southern Fusiform Rust.* The southern fusiform rust (*Cronartium fusiforme*) is one of the most important diseases of slash and loblolly pines, and breeding for resistance is an integral part of the forest genetics program. Probable sources of resistance are the naturally resistant shortleaf pine, and certain individuals among the susceptible species. Mass artificial inoculations of cotyledon-stage seedlings in the nurserybed and one- to three-year-old potted plants have resulted in macroscopic symptoms on 70 to 80 per cent of the seedlings from non-selected trees of susceptible species eight months after treatment; there has been close correlation between the initial leaf or stem symptoms and the subsequent fusiform canker development. After similar inoculation, some seedlings, resulting from open-pollinations of selected rust-free slash pines in area of high natural incidence, have shown initial symptoms but no later cankers. F_1 inoculated progenies of shortleaf × slash and shortleaf × loblolly crosses have consistently remained canker-free regardless of initial symptoms. In the field, F_1 progeny of shortleaf × loblolly crosses have remained free of fusiform cankers for five years in an area of high incidence. Through selection, hybridization, and progeny-testing by artificial and natural means, the program of breeding for resistance to southern fusiform rust holds promise of success.

JIMBÔ, TADAO. Tôhoku University, Sendai, Japan. *Tertiary Pollen Floras of Japan.* The Pliocene lignite widely distributed in Japan is characterized by a series of pollen floras, which are more or less dominated by taxodaceous genera such as *Sequoia* (*or Metasequoia*) and *Taxodium* (or *Glyptostrobus*) not surviving there to-day. These taxodaceous plants frequently flourished very luxuriantly, whereas pinaceous ones were on the whole not abundant. However, the taxodaceous plants mentioned above are seldom found in the latest Pliocene pollen flora. Among deciduous trees associated with the coniferous ones, *Alnus* is of special interest in that it often occurred in great abundance, particularly when the taxodaceous trees were not predominant, though it was superseded by *Fagus* from time to time. The amount of *Alnus* pollen is, to some extent, correlated with the ash content of the deposit. The Miocene lignite in this country shows, like that of the Pliocene, a pollen flora consisting of *Sequoia, Taxodium,* and the closely allied genera, as well as *Pinus* and other conifers and a variety of deciduous trees. It is to be noted that juglandaceous pollen is plentiful in Miocene deposits as a rule.

JOHNSON, MARION A. *See* FAIRBROTHERS, DAVID E.

JONES, JOHN D., and GLEB KROTKOV. Queen's University, Kingston, Ontario. *Incorporation of $C^{14}O_2$ into Protein Amino Acids by Chlorella Cells in Either White or Blue Light. Chlorella vulgaris* cells were inoculated into sterile inorganic medium (containing ammonium nitrate) contained in a 9-litre culture bottle. $C^{14}O_2/C^{12}O_2$ mixture was introduced into the system and the culture bottle mounted horizontally on rotating rollers. The bottle was illuminated by a bank of 18 cool white fluorescent tubes overhanging the culture bottle in the shape of an inverted U. The system was maintained at 25° C. Blue light was obtained by placing transparent blue "cellophane" between the light source and the culture. The cells were harvested when the cell population reached 15.5 million per ml.; the unused CO_2 was recovered, and the NH_4 ion and NO_3 ion remaining in the culture solution estimated. The centrifuged cells were extracted in turn, with cold methanol, cold 5 per cent trichloracetic acid, ethanol, hot 5 per cent trichloracetic acid, and hot ethanol to leave a residue essentially cell-wall debris and protein. The residue was hydrolysed and the amino acids released separated by ion exchange resins and each quantitatively determined. The specific activity of each amino acid was determined. A balance sheet of the results for growth in white light and blue light is presented.

JONES, KEITH. University College of Wales. *Abrupt Speciation.* This paper reviews present knowledge of abrupt ecospecies — their origin, significance, and evolution. It considers also the relation between taxonomy and biosystematics in the classification of such entities.

JONES, L. H. University of Birmingham. *The Uptake of Aluminium by Plants.* Aluminium has been shown to be available to plants growing on pulverized coal waste ash (fly-ash) at pH values from 7.5 to 11. The factors influencing aluminium uptake and toxicity under these conditions are discussed, and sensitivity to aluminium toxicity is correlated with the physiology of different ecological types. The stability of aluminium complexes with citric, malic, and other organic acids suggests a means whereby aluminium could be absorbed in a soluble non-toxic form by plants exuding such acids from their roots. Plants not producing organic acids in root exudates would suffer the usual symptoms of induced phosphate deficiency in the tops, and a deposition of aluminium and phosphate in or on the roots when exposed to excess aluminium.

JONES, REUBEN G. Eli Lilly and Company, Indianapolis. *Precursor Control of Antibiotic Biosynthesis.* A detailed knowledge of the chemical structure of an antibiotic may suggest simple chemical compounds or precursors that can be used by the micro-organism and incorporated into the antibiotic. In some cases, the addition of such chemical precursors to the culture medium increases the yield of antibiotic. In other cases, the chemical structure of the antibiotic may be controlled by addition to the culture medium of an appropriate precursor. Most of the important antibiotics are individual members of closely related groups of chemical compounds. Sometimes the most desirable member of such a group is not the one that normally occurs in highest yield from a given culture medium. It has been possible in a number of cases not only to control the chemical type and yield of an antibiotic but also to produce entirely new members of a group by the use of suitable precursors. The penicillins have been most extensively studied in this connection and detailed examples will be given. The use of precursors in the biosynthesis of certain other antibiotics will be discussed also.

JONES, W. W. *See* LABANAUSKAS, CHARLES K., *et al.*

JORGENSEN, ERIK. University of Toronto. *Fomes annosus Root Rot.* The paper gives an outline of the mycological characteristics, geographical distribution, and general occurrence of *Fomes annosus.* The symptoms of root and butt rot caused by this fungus are described as they occur in spruce, larch, Douglas fir, pine, and hardwood species. The spread and infection are discussed with special reference to a hypothetical spread by man and the competitive relations of the fungus to other micro-organisms. An outline of predisposing factors is given, illustrated with the results of infection experiments and field observations. Finally, the host-parasite relationships are discussed, expressing the author's over-all biological appraisal of *Fomes annosus.*

JORGENSEN, ERIK. University of Toronto. *On the Appraisal of Forest Tree Diseases and Forest Pathology.* Some of the difficulties in the calculation or estimation of economic losses caused by forest tree diseases are discussed. It is concluded that an appraisal in dollars and cents of forest pathology research, which in recent years has been attempted by some forest pathologists, is impossible and misleading. Forest pathology should be recognized as an applied science and should be evaluated by progress in knowledge and biological understanding. It cannot rightly be evaluated by the more or less immeasurable damage caused by forest tree diseases. The prime importance of forest pathology is seen in the contribution made by this science to our fund of silvicultural knowledge concerning the growth requirements of forest trees, and the proper biological management of the crops.

JUCCI, CARLO. Università, Pavia, Italy. *Physiogenetic Researches on Cultivated and Wild Plants (Solanum, Lycopersicum, Forage Grasses, and Legumes) at the Apenninic Centre (Terminillo, Rieti, Italy).*

JUST, THEODOR. Chicago Natural History Museum. *Synopsis of Living and Fossil Cycadaceae.* Our knowledge of the taxonomic status, typification, morphology, distribution in space and time, relationships, and evolutionary trends of Cycadaceae is summarized in the light of new information and concepts.

KAMIYA, NOBURÔ. Osaka University. *Protoplasmic Streaming.* Among various types of protoplasmic streaming in diverse materials, rotation in *Nitella* and shuttle streaming in plasmodia of *Physarum polycephalum* have been best investigated. The motive force of rotation is regarded as a force causing shifting at the interface between the cortical gel layer and outer edge of the endoplasm. This force is estimated to be 1-2 dynes/cm.^{2} through centrifuge-microscope studies and density determination of endoplasm and cell sap. The motive force of the streaming in plasmodia can be measured by the "double-chamber method," which, when modified, enables us to measure the motive force and respiration simultaneously. Reactions of the motive force to various reagents indicate that energy liberated by fermentation rather than respiration is available for streaming in plasmodia. It has been demonstrated in *Physarum plasmodia* that adenosine triphosphate (ATP) is present at the concentration of 4×10^{-4} *M* under active state, and that there is an actomyosin-like contractile protein which has ATPase activity. Application of ATP from without or through micro-injection augments the motive force conspicuously. Data so far obtained indicate that the myosin-ATP system constitutes the mechano-chemical coupling behind the protoplasmic streaming in the slime mould just as it is in muscle contraction.

KANDLER, OTTO. Bakteriologisches Institut der Süddeutschen Versuchs- und Forschungsanstalt für Milchwirtschaft, Weihenstephan. *Der Einfluss verschiedener Stoffwechselgifte auf den Weg des Kohlenstoffes in der Photosynthese.* Der Einfluss von Stoffwechselgiften auf die Verteilung von C^{14} nach kurzfristiger Photosynthese von *Chlorella* in $C^{14}O_2$ wurde nach der von Calvin u.Mitarb. entwickelten Methodik untersucht. (1) HCN hemmt die Carboxylierungsreaktion sehr stark, während der Reduktionsschritt praktisch nicht beeinflusst wird. Dementsprechend wird Ribulosediphosphat (RuDP) angestaut, während Phosphoglycerinsäure (PGS) fast ganz verschwindet. Eine Anreicherung von Triosephosphat, die man in Analogie zu den Befunden bei der Glycolyse erwarten würde, konnte selbst bei m/10 HCN nicht beobachtet werden. Dagegen trat bei hohen Konzentrationen ein bisher unbekanntes, glukosehaltiges Nukleotid auf.

(2) Phenanthrolin hemmt in hohen Konzentrationen die Reduktion und führt zur Anreicherung von PGS. (3) Hydroxylamin und Hydrazin hemmen wie Phenanthrolin die Reduktion. Die angestaute PGS wird fast ausschliesslich zu Äpfelsäure verwandelt. Die Bildung von Alanin und Asparaginsäure ist gehemmt. Unter bestimmten Bedingungen treten Phosphatester auf, die nach Dephosphorylieren Verbindungen mit ähnlichen Eigenschaften liefern, wie sie Moses und Calvin der x-und β-Ketosäure zuschreiben. (4) Monojodessigsäure hemmt ebenfalls die Zuckersynthese und die angestaute PGS wird zu verschiedenen organischen bzw. Aminosäuren weiterverarbeitet. (5) Dinitrophenol, Arsenat, Azid und Arsenit bedingen eine deutliche Verminderung der PGS, aber keine Anreicherung von RuDP. Organische Säuren sind nicht vermehrt. Die meisten Effekte sind auf der Basis des Calvin-Bensonschen Photosynthesecyclus verständlich. Einige Befunde bedürfen weiterer Klärung.

KAPICA, LUCIA, A. COMMON, R. EDITH, and F. BLANK. McGill University, Montreal. *The Influence of Glucose on the Keratinolytic Activities of Yeasts and Fungi.* *Candida albicans* and *Candida parapsilosis* were cultured on liquid media with particulate (40-100 mesh) water-extracted, hoof keratin and human nail keratin as sole source of nitrogen. Abundant growth was visible in one to two weeks. Increasing amounts of soluble N accumulated in the medium over a period of five months (54.8 μg./ml. after four months); and recalculation of the total nitrogen in the culture filtrates, after consideration of nitrogen absorbed by the mycelium, revealed that about 22 per cent of the keratin-N was mobilized by these organisms in four months. The yeasts could not be cultured in a keratin medium in the absence of glucose, the optimum concentration of the latter for growth being 1-2 per cent. Conversely, *Scopulariopsis brevicaulis* could be cultured in similar media in the absence of glucose, thus utilizing keratin as sole source of nutritional requirements. Abundant and characteristic growth developed in two weeks and analysis of culture filtrates during a six week period showed steady accumulation of soluble nitrogen (e.g., 300 μg./ml. in six weeks) of which 60-80 per cent could be determined as free ammonia. Presence of glucose (0.5 per cent—4 per cent) markedly inhibited visible growth and accumulation of nitrogen in medium even in shaking cultures.

Microsporum canis and *Trichophyton granulosum*, noted for keratinolytic activities, behaved similarly to *S. brevicaulis* except that glucose appears to have lesser inhibitory effects especially in shaking cultures.

KAPLAN, LAWRENCE. Roosevelt University, Chicago. *Domestication in Tagetes.* In sixteenth-century and pre-Colombian depictions, two or possibly three species of American marigolds, including single- and double-flowered forms, are represented. In Middle America marigolds are used especially in celebration of All Saints Day and the Day of the Dead in ways which undoubtedly reflect prehistoric tradition. The use of marigolds in Middle America as funeral, altar, and grave ornamentals suggests the basis for varietal selection. A form of self-sowing, with human assistance, in trash heaps and gardens perpetuates the selected varieties in the Mayan highlands where the plants grow as semi-volunteers.

KAMIYA, N., M. TAZAWA, K. KURODA, and R. NAGAI. Osaka University, Japan. *Self-control of the Osmotic Pressure in the Plant Cell.* A prerequisite for the study of the self-control of the osmotic pressure of a cell is a technique that would enable us to obtain cells having abnormal osmotic pressures, both high and low. By tying off an internodal cell of *Nitella flexilis* with strips of fine thread after inducing transcellular osmosis, we are able to produce cell fragments having various osmotic pressures over a range from as low as one-quarter to as high as three times the normal level which is equivalent to 0.26 *M* sucrose. The fragments of an internodal cell thus produced have a marked tendency to restore their deviated sap concentrations to the normal level. This recovery process is usually accompanied by parallel changes in electrolyte concentration, especially potassium concentration, of the external solution. The self-regulatory mechanism of osmotic pressure, however, can also function, if not fully, independently of the import or export of solutes to or from the cell. Turgor pressure plays no essential role in osmoregulation.

KASAPLIGIL, BAKI. Mills College, Oakland, California. *The Ecological Foliar Anatomy of Certain Xeric Monocotyledons.* The foliar histology of eighteen species of geophytic monocotyledons representing Araceae, Liliaceae, Gramineae, Iridaceae, and Orchidaceae have been described in the present study. The research materials were collected wholly from the Central Anatolian (Asia Minor) steppic region that represents a typical semi-arid environment. The plants studied exhibit certain uniformities, such as leaf shape, geophytism, root distribution, osmotic concentrations, and phenological periodicity. Xerophytic characters of the leaves are: reduction of the surface (*Crocus ancyrensis, C. suterianus*), folded blade (*Gladiolus atroviolaceus, Iris aphyllus*), revolute leaf (*Allium rotundum, Hordeum bulbosum, Poa bulbosa*), trichomes (*Allium stamineum, Muscari comosum, Ornithogalum narbonense* var. *pyramidale, Gladiolus atroviolaceus, Iris aphyllus*), thick cuticle (*Merendera trigyna, Muscari racemosum, Gagea arvensis, Allium, Ornithogalum, Crocus* spp.), sunken stomata (*Allium, Merendera, Muscari, Ornithogalum, Gladiolus, Crocus* spp.), isolateral mesophyll (*Allium stamineum, Merendera, Muscari comosum, Ornithogalum, Gladiolus, Iris* spp.), epidermal water storage (*Limodorum abortivum, Orchis mascula* ssp. *pinetorum*), water storage in mesophyll (*Allium, Gagea, Muscari, Ornithogalum, Crocus* spp.), sclerenchyma (*Crocus, Gladiolus, Iris, Hordeum, Poa* spp.), well-developed vascular tissue (all of them). In spite of the adaptive responses of any particular tissue to the xeric environment, the anatomical structures of the monocotyledonous leaves studied are highly specialized and the pattern of tissue organization is distinct even between the species of the same genus.

KASSANIS, B., and A. F. POSNETTE. Rothamsted Experimental Station, Harpenden, and East Malling Research Station, England. *Thermotherapy of Virus-infected Plants.* The most effective and simple therapeutic treatment for virus-infected plants is to maintain them for a period at relatively high temperatures. Therapy can be achieved either by immersing the infected plants in water at about 50° C. for several minutes or by keeping actively growing plants at about 37° C. for several days. The first method is applicable to some thermolabile viruses affecting woody and a few herbaceous plants that can survive the high temperature. The second method, on the other hand, is effective with a much wider range of virus and plants, including viruses which are thermostable in heat inactivation tests made *in vitro*; this method is academically the more interesting and the more widely practised. The two methods will be described together with some examples of successful application, and possible explanations of their mode of action will be discussed with reference to differences in the behaviour of viruses to the treatments. Finally suggestions will be made on the type of organization which might help the grower to produce and increase healthy stocks from varieties which were totally infected.

KASTING, ROBERT, A. J. MCGINNIS, and W. C. BROADFOOT. Science Service Laboratory, Alberta. *The Biosynthesis of Amino Acids by Germinating Uredospores of Puccinia graminis tritici (Pers.) Erikss. and Henn. from Sucrose Labeled with Carbon-14.* An indirect method for determining amino acid requirements was applied to germinating uredospores of wheat-stem rust (*Puccinia graminis tritici* (Pers.), race 15B). Spores were germinated in a dilute solution of uniformly labeled sucrose-C^{14}. The carbon dioxide evolved contained radioactivity, showing that sucrose-C^{14} was metabolized under these conditions. The germinated spores and mycelium were acid hydrolysed and the hydrolysate was fractionated by ion exchange column and paper chromatography. Most of the common amino acids were identified and their specific activities were determined. Glutamic acid, alanine, and valine, among others, were labeled, showing that they were synthesized from sucrose. At least for the early stages of germination and growth it appears that these amino acids need not be supplied by the host plant. The implications of the quantities of radioactivities in other amino acids will be discussed.

KATZ, E., and H. LECHEVALIER. Rutgers, The State University, New Jersey. *Nutritional Control of Antibiotic Synthesis as Applied to Actinomycin and the Polyene Antifungal Agents.* The actinomycins represent a family of chromopeptide antibiotics which differ in their amino acid composition. Generally, an actinomycin-producing organism synthesizes a number of these compounds. The nitrogen source supplied influences markedly the quantitative and qualitative composition of the actinomycins formed. Sarcosine selectively affects the production of actinomycins II and III by *Streptomyces antibioticus*. The amount of II and III formed depends, in part, on the concentration, the time, and the number of sarcosine additions made. Exogenous L-proline reverses the sarcosine effect. Chemical studies reveal that actinomycin II contains four sarcosine residues but no proline, whereas actinomycin III possesses three sarcosine residues and one proline molecule. Several new actinomycins are formed in the presence of DL-pipecolic acid. Two of the new components were examined and found to contain pipecolic acid. The data suggest that exogenous sarcosine and pipecolic acid compete with and replace endogenously synthesized proline in the peptides of some of the actinomycins. D-valine inhibits actinomycin synthesis; L-valine, however, selectively increases the synthesis of actinomycin IV by *Streptomyces chrysomallus*. The influence of other amino acids on actinomycin formation will be discussed. A strain of *Streptomyces aureus* produces antimycoin A, a polyenic antifungal antibiotic, when mevalonic acid is added to a solid medium. Addition of mevalonic acid to a chemically defined liquid medium fails to induce the formation of the antibiotic; incorporation of high levels of Ca^{++} and/or Mg^{++} ion (± 5,000 p.p.m.) does, however. Mevalonic acid plus a high level of cation resulted in more rapid production and larger yields of the polyene. Labeled mevalonic acid was not incorporated into antimycoin A. A possible relationship between the porphyrin metabolism of the organism and production of the polyene antibiotic was suggested.

KATZNELSON, H. Microbiology Research Institute, Canada Department of

Agriculture. *Micro-organisms in the Rhizosphere.* The root zone is the site of intense microbiological activity. The soil at the root surface (the rhizosphere) contains much larger numbers of bacteria and a more abundant population of fungi, actinomycetes, protozoa, and, frequently, of nematodes than soil away from the root. Numbers of algae are little affected. Roots also exert a selective action on the organisms in their vicinity. Thus, bacteria requiring amino acids for optimal growth, bacteria capable of vitamin synthesis, and ammonifying and denitrifying forms are preferentially stimulated in the root zone as are organisms capable of reducing methylene blue and of fermenting glucose with the production of gas. Further studies have shown that, in general, rhizosphere bacteria grow more quickly and are capable of oxidizing substrates such as glucose, alanine, acetate, and succinate more rapidly than those from the soil beyond the zone of root influence. These rhizosphere effects are influenced by the type and age of plant and the environmental conditions under which it is growing (type, reaction, and moisture content of the soil, temperature and light). The significance of this qualitative and quantitative alteration of the soil microflora by plant roots is discussed.

KATZNELSON, H. *See* HOCHSTER, R. M.

KAUR, RAVINDER. *See* GALSTON, A. W.

KEENAN, J. *See* GREEN, P. S.

KEEVER, CATHERINE. *See* QUARTERMAN, ELSIE

KEITT, G. W. *See* BOONE, D. M.

KELMAN, ARTHUR. North Carolina State College. *Tissue Disintegration and Wilt Induction in Plants by Bacterial Pathogens.* Phytopathogenic bacteria that macerate plant tissue typically form polygalacturonases that readily hydrolyze the α-1,4 glycosidic linkages of pectic substances. These enzymes are usually most active above pH 6.5 and the presence of the substrate is not essential for their production. Several *Erwinia* isolates form a bacterial depolymerase or endopolymethylpolygalacturonase which hydrolyzes pectin without formation of galacturonic acid residues. Other *Erwinia* isolates can hydrolyze pectic substances to monogalacturonic acid residues, however. Bacterial endopolymethylpolygalacturonase is similar to protopectinase in major properties. In general, *Erwinia* spp. form very low levels of pectinmethylesterase. Species of *Corynebacterium* and *Agrobacterium* which do not macerate host tissue and non-phytopathogenic bacteria usually do not form pectinmethylesterase. Certain bacterial pathogens form cellulolytic enzymes (Cx); however, the cellulases may not play a major role in tissue disintegration for soft-rot bacteria. Pectinmethylesterase, polygalacturonase, and cellulase (Cx) of the wilt bacterium, *Pseudomonas solanacearum,* are involved in disintegration of vascular and parenchymatous tissue of infected plants. However, the main wilt-inducing factor is an extracellular slime or polysaccharide formed by virulent strains but not by weakly virulent or avirulent variants of *P. solanacearum.*

KENDRICK, W. BRYCE. University of Liverpool and Plant Science Institute, Ottawa. *Succession in the Pine Needle Microhabitat.* The demonstration presents some of the more important aspects of the predominantly fungal and faunal decomposition of *Pinus sylvestris* leaf litter under strongly acid mor conditions in Northern England. Apothecia and "diaphragms" of *Lophodermium pinastri,* and pyonidia of *Fusicoccum bacillare,* develop in needles of the superficial "L" layer of litter. When these needles have been covered by further deposition of litter, and their moisture content rises, more extensive colonisation occurs, externally by *Helicoma monospora* and *Sympodiella acicola,* and internally by *Desmazierella acicola.* The primary colonisers are superseded, and needles assume the characteristics of the F_1 layer. Endophagous meiofauna now attack the softened needle tissues, and ectophages browse on the numerous superficial fungal fruiting structures as needles enter the F_2 layer. Physical reduction of the needles is complete about seven to ten years after they have fallen to the ground, and the lowest organic stratum, termed the "H" layer, consists largely of partly humified animal faeces, and numerous dead dematiaceous hyphae, conidiophores, and conidia. In the pine needle microhabitat successive waves of fungal colonisation initiate the decomposition process, complete physical reduction eventually being brought about by the fauna. Slowly decaying mor-type or organic horizons of the type discussed above favour the study of microbiological succession, as they often develop characteristic strata corresponding to well-marked stages of decomposition.

KENG, HSUAN. University of California. *Morphological Studies of the Theaceae.* A comparative study of the seed, seedling, leaf, stem, root, flower, and fruit characters of the representative members from the two subfamilies, Ternstroemioideae and Camellioideae will be presented, with special reference to those of *Cleyera* and *Tutcheria.*

KENWORTHY, A. L. Michigan State University. *Interpreting the Balance of Nutrient Elements in Leaves of Fruit Trees.* Difficulties involved in obtaining a visual concept and mathematical expression of nutrient-element balance or unbalance for fruit trees are discussed. A method is presented that provides (1) a chart for graphically illustrating the balance or unbalance for an orchard, treatment, or sample; (2) a numerical expression of the relative balance for each nutrient element; and (3) a numerical expression of the relative balance for an orchard, treatment, or sample. The Nutrient-element Balance Chart divides the range of nutritional conditions into five zones as follows: deficiency, hidden deficiency, normal, approaching excess, and excess. Each zone is of equal magnitude with the standard or normal values representing the median position of the normal zone. Data for each element are placed on the Nutrient-element Balance Chart by calculating the percentage deviation from standard values for each element. The percentage of standard values is then adjusted toward 100 in accordance with the coefficient of variation for each element. This adjustment results in reducing the apparent shortage or excess according to the variation found in normal plants for each element. The final calculation provides a "balance index" for each element. A summation of the balance indices provides a single numerical expression for the relative balance of the condition being studied. The selection of the population used to establish the coefficient of variation for each nutrient element is illustrated and discussed. Evidence favors the use of a population from one orchard or experiment rather than random orchards representing many orchard conditions, soil types, and tree ages. The accuracy of leaf analysis in diagnosing nutritional conditions may be questioned if the coefficient of variation is too high for a particular element.

KEPHART, JOYCE E. *See* WHALEY, W. GORDON, *et al.*

KERN, FRANK D. Pennsylvania State University. *The Changing Concepts of Gymnosporangium.* This study recounts the various ways in which the concepts of *Gymnosporangium* (a genus of the Uredinales) have been extended through biologic, cultural, and taxonomic investigations. Originally only a telial stage was known with 2-celled teliospores invested with a variable amount of gelatinous material, the mycelium parasitic on different Cupressineae (Juniperaceae) producing various distortions; uredinia were lacking. Cultural proof linked these telial stages with aecial stages on different Pomeae (Malaceae) having elongated peridia, peridial cells with variously sculptured walls, and aeciospores with deeply colored walls. The species were thought to be few in number. It is now believed that more than sixty species deserve recognition, including several aecial stages for which telial stages have not yet been found. In some species the peridial cells are smooth and the aeciospores light in color. One species is autoecious; two have uredial stages; some have multicellular teliospores while one has only 1-celled teliospores; several have aecidiod aecia (i.e., cup-like and not elongated or cornute); at least four species have aecial stages on hosts other than Pomeae, namely Spiraeeae, Hydrangiaceae, and Myricaceae; several species occurring on the leaves or green parts do not cause distortions. There are no exceptions to the telial stages being restricted to the Juniperaceae and the telia being more or less gelatinous when moistened.

Kessler, B. Hebrew University, Rehovot, Israel. *Nucleic Acids as Factors in Drought Resistance of Plants.* Several workers have found that heat-tolerant pea varieties contain considerably more adenine than heat-sensitive ones and heat tolerance is increased by application of adenine. These findings are now corroborated for entire bean plants and peach and grape-vine leaves; in these experiments adenine also increased the tolerance to drought. The "induced" heat and drought tolerance was most pronounced when adenine was applied to germinating seeds, young seedlings, and very young leaves. Induced drought tolerance of adenine-treated plants was accompanied by a considerable increase of the desoxyribonucleic acid/ribonucleic acid ratio as well as of another cytoplasmatic constituent, with a lipid-nucleoprotein structure. The bond between the lipid and nucleoprotein components was found to be sensitive to heat and dehydration. With sunflower seedlings certain inverse relations for water stress, growth, and the levels of nucleic acids were found. Some possible relations between cell size, certain nucleic acid fractions, and the tolerance of plants to drought, heat, and water stress will be discussed.

Kessler, B. Agricultural Research Station and Hebrew University, Rehovot, Israel. *Ribonuclease as a Guide for the Determination of Zinc Deficiency in Orchard Trees.* Recently it was shown (B. Kessler and S. P. Monselise) that one of the more specific functions of zinc in fruit trees is its regulating effect on the ribonuclease (RNAase) activity, thus controlling the metabolism of ribonucleic acid and protein. In the course of this work, it became obvious that inverse relations exist between the internal zinc concentration of leaves and their RNAase activity. In all tested cases of visual zinc deficiencies the RNAase activity of the leaves was above 35-40 per cent substrate hydrolysis, and usually higher than 55-60 per cent. In two apple varieties (Rome Beauty and Grand Alexander), the inverse relations between RNAase and zinc were compared to the corresponding yields. For both varieties two typical rate-limiting curves were obtained for the zinc-yield relations. From these curves the critical concentrations of zinc, where maximum yields were attained, were tentatively established to be around 65 p.p.m. and 43 p.p.m., respectively. But in both cases the RNAase activity around these critical zinc concentrations (and above them) was below 35-40 per cent. In other experiments, where the critical zinc level was found to vary with the calcium concentrations of the leaves, it was again learned that at the optimal Ca/Zn ratio, where highest yields were attained, the RNAase activity was below 35-40 per cent. Similar RNAase activities were found in healthy orange and grapevine leaves. It is well known that critical values of a nutrient element might considerably vary through interaction between different ions, between different species, varieties and rootstocks, etc., all these being factors which possibly affect the efficiency with which a tree may utilize functional elements. From the above and other results, it appears that from the point of view of the diagnosis of zinc deficiencies it might be of practical value to determine leaf RNAase; its critical level was tentatively found in a few species to be around 35-40 per cent. In case of a higher RNAase activity, zinc deficiency must hence be suspected, irrespective to the amount of zinc actually found in these leaves.

KESSLER, B. Hebrew University, Rehovot, Israel. *Some Effects of Purine and Pyrimidine Bases and Certain Cofactors upon Maturation and Flower Bud Formation.* In previous work it was found that in developing leaves the ribonucleic acid/desoxyribonucleic acid ratio increases continuously, and a similar increase could be brought about by application of caffeine, xanthine, and uracil. This ratio and its increase, natural or induced, is lower in young than in bearing fruit trees. In several instances caffeine, xanthine, and uracil also increased considerably the formation of flower buds. In other cases no such effect was obtained. It was found, however, that in the latter case caffeine and uracil did promote flowering when combined with a growth inhibitor and a substituted phenol, these two components apparently acting as cofactors. The possible interactions between nucleic acids, purines and pyrimidines, growth regulators, and substituted phenols in maturation processes and flower bud formation will be discussed.

KETALLAPPER, M. J. California Institute of Technology. *The Effect of Interaction between Temperature and Length of the Light-Dark Cycle on Plant Growth.* The effects of temperature on plant growth are changed by the length of the light-dark cycle, which normally is 24 hours. The phenomenon has been studied extensively in tomatoes and peanuts. Plants are grown under a constant temperature and the cycle length is varied. The plants receive equal amounts of light and darkness. Seedlings are raised under a normal light-dark cycle before transfer to experimental conditions. At 20° C. the optimum cycle length is close to 24 hours, but the optimum length decreases with increasing temperature, and the reverse. At 13° C. the optimum cycle length is 27-30 hours and at 30° C. it is 20 hours. Up to 70 per cent of the loss in dry weight due to unfavourable temperature can be recovered by adjusting the cycle length to the optimum value for that temperature. Low-temperature (13° C.) induced chlorosis in peanuts disappears when the cycle length is increased to 27 hours. The interaction between temperature and cycle length may be explained in terms of a slight temperature sensitivity of an internal clock. This causes the internal cycle to be out of phase with the outside cycle, and growth is reduced. An internal rhythm is also indicated because different results are obtained with plants raised in continuous light and constant temperature.

KEYWORTH, W. G., and J. SHEILA HOWELL. National Vegetable Research Station, Wellesbourne, England. *Silvering Disease of Red Beet.* This disease, first seen in Britain in 1945, attacks the seeding crop of red beet (especially Cheltenham Greentop) causing a leaf silvering, followed by wilting and death. It also occurs on sugar beet and mangolds, but on these crops its effects are less severe. The causal organism is *Corynebacterium betae* Keyworth, Howell and Dowson. The bacterium is seed-borne in about 1 per cent of the seeds from an infected crop and these seeds grow into seedlings showing systemic infection. Spread of the pathogen occurs in the seedling bed during the winter, secondary infection arising especially around leaf edges with subsequent systemic invasion. The bacterium can also be spread on pruning knives, etc. The disease is effectively controlled by soaking seed in solution of 0.02 per cent streptomycin or (less effectively) by treating seed with mercurial dusts.

KHACHIDZE, O. T. *See* DURMISHIDZE, S. V.

KHUDAIRI, A. K. University of Baghdad. *Studies on the Streptomycin and the Flowering of Xanthium in Relation to Photoperiodism.* Streptomycin solution of 0.2 per cent was found to bleach *Xanthium* leaves of 3 cm.^{2} without injury. The streptomycin-treated leaves expand and reach full size without the development of chloroplasts. *Xanthium pennsylvanicum* and *X. strumarium* are short-day plants and flower when given photoperiodic cycles with short days (long nights). *Xanthium* plants with single streptomycin-bleached leaf cannot be induced to flower by short days, while plants with a single green leaf flower under the same photoperiodic conditions. Streptomycin solution when applied to fully expanded green leaves does not inhibit flowering. Two explanations were suggested for the failure of such plants to flower under favorable photoperiodic conditions: (1) the lack of chloroplasts, and (2) the inhibition of some enzyme system(s) which may take part in the formation of the flowering hormone during the dark reaction.

KHUSH, G. S., and G. L. STEBBINS. University of California. *Variation in the Organization of the Guard Cell Complex in the Leaf Epidermis of Monocotyledons and Its Bearing on Their Phylogeny.* The stomata in the leaves of many species of monocotyledons contain, in addition to two guard cells, two or more subsidiary cells. These develop through a pattern of interaction between nuclei of guard mother cells and the adjacent epidermal cells. The pattern of development is characteristic for each type of guard cell complex. Various guard cell complexes have been divided into five broad categories as follows: (1) two guard cells and four well-differentiated subsidiary cells, with two to five additional subsidiary cells intergrading with epidermal cells; (2) two guard cells and four well-developed and sharply distinct subsidiary cells; (3) two guard cells and two well-developed subsidiary cells placed laterally to the guard cells; (4) two guard cells and two small subsidiary cells placed at the ends of guard cells; (5) two guard cells without any subsidiary cells. In the material examined, the type of complex has been found constant within a genus and usually constant within the tribe or family. The type with many subsidiary cells appears to be the most primitive and ancestral to the other types. Data have been gathered on several families of monocotyledons. The bearing of these data on the present classification will be discussed and certain revisions suggested. (This research was supported by National Science Foundation Grant no. G-3737.)

KIM, CHOON MIN. Seoul National University. *Effect of Saline and Alkaline Salts on the Growth and Internal Components of Selected Vegetable Plants.* The effect of saline and alkaline salts on the growth as well as the internal components of the leaves of ordinary vegetable plants under soil culture was investigated. The results have indicated that a small variation in the relative concentrations of the two salts in the soil has had a marked influence on the internal components of three plants. Reduction of growth was associated with increasing intensity of salts although no significant difference was evident. Chlorophyll and carotene content in the leaves of three plants was depressed with increasing concentration of two types of salts, but the different effect of the two salts was not significant. There was a high degree of concomitance between growth rate and the chlorophyll and carotene content. In contrast, the ascorbic acid content in the leaves of cabbage and radish treated with two salts increased in proportion to the degree of concentration of the two salts in cabbage. Chlorophyll and ascorbic acid values differed greatly during the two experiments and the difference was significant.

King, Lawrence J. Boyce Thompson Institute for Plant Research, Inc., Yonkers, N.Y. *Some World Aspects of the Biology and Control of Weeds.* Weed science involves the study and control of the more aggressive and troublesome elements of the world's vegetation — centered about man's activities. "Weed" probably had its origin either from the Anglo-Saxon or the proto-Germanic names for the ancient cultivated dye-crop, woad (*Isatis tinctoria* L., Cruciferae) (cf. Nature *179:* 1366, 1957). A study recently completed of the principal noxious vascular plants of the world — upon a gross-regional catalogue basis — includes some 10,000 entries (*World Encyclopedia of Weeds and Their Control,* London: Leonard Hill Ltd., in press). Anthropophytes (man-encouraged plants) and apophytes (native species venturing into man-created areas) are recognized as the two great groups from which weeds are derived. Man has encouraged weeds through tillage and the nitrophilous habitat, and through winnowing of grain has selected weed seeds along with crop seeds such that the former often simulate the crop seed not only in weight but in shape or outline — termed the voilure principle. With the recent discovery of *Striga* infesting maize in the Carolinas, the threat of parasitic seed plants to agriculture is now acute in the New World as well. Other genera destructive to useful plants elsewhere in the world include: *Arceuthobium, Orobanche, Viscum, Thesium, Loranthus, Ramphicarpa, Aeginitia, Melasma.* Earlier writers discouraged the use of "weed species," but with the recognition of agricultural ecotypes this objection appears no longer entirely valid. The widespread field weeds have migrated in a westerly direction from the early centers of civilization in the eastern Mediterranean area. The survey has shown that, while there are sizable numbers of both pantemperate and pantropic weeds, the major number of weeds appear restricted to smaller areas and are derived from the respective native floras. With the introduction of the growth hormone herbicides, 2,4-D and MCP, in the late 1940's a new era of chemical weed control became possible through the attractive features of low poundage and high selectivity. With a knowledge of weed biology — including biochemistry — more efficient control measures may be planned together with a better understanding of persistence, selectivity, mode of action, and development of herbicide resistance.

Kiraly, Z. *See* Farkas, G. L., *et al.*

Kitamura, Siro. Kyoto University, Japan. *The Flora of Afghanistan.* The total number of species of flowering plants hitherto known from Afghanistan (area: about 635,000 sq. km.) is 2,458 (it was 1,750 before 1950), including Sympetalae 935, Choripetalae 1,180, Monocotyledoneae 329, and Gymnospermae 14. The families which are supposed to be most advanced in their respective orders have many species: Compositae, 416; Leguminosae, 344; Labiatae, 160; Graminae, 148; Cruciferae, 143. These families have also many young endemics.

Through the arid climate of the past, few relics are preserved. Many new species have been created in this vacant area under the arid climate among easily varying families (so-called advanced families from the classical floral morphology). For comparison, the flora of Japan is considered. The total number of species of flowering plants of Japan (area: about 369,665 sq. km.) is 3,649, including Sympetalae 629, Choripetalae 1,839, Monocotyledoneae 1,140, and Gymnospermae 41. The advanced group Sympetalae are rather poorly represented, while Monocotyledoneae and Gymnospermae are well preserved: Compositae, 360; Leguminosae, 97; Labiatae, 86; Graminae, 231, Cruciferae, 65. Through the humid and warm climate of the past many Tertiary species have survived. Also young endemics have been created in the isolated areas from various sources (areas devastated by volcanic action, etc.).

KLAEHN, FRIEDRICH ULRICH. University of Syracuse, New York. *Flower Ecology and Flower Morphology in Breeding Procedures.* Flower ecology and morphology of certain hardwood tree species are much more complex than those of conifers. *Fraxinus* and *Acer* are examples of two genera which present special problems when one is carrying out intra- and inter-specific hybridization procedures. In this report a few species of the genera mentioned above are compared with each other with respect to sex conditions, time of flower ripening, pollen dissemination and receptivity. The possibilities of overcoming breeding difficulties are discussed.

KLINE, H. J. *See* MILLER, HELENA A., *et al.*

KLINKOWSKI, MAXIMILIAN. Martin Luther University, Halle-Saale, Germany. *A Virus Disease of Rhubarb in Germany.* Since 1948 disease symptoms caused by virus have been observed on rhubarb in Germany. This virus disease, named rhubarb mosaic, was reported for the first time in 1957 at the 4th International Congress of Plant Protection in Hamburg. The identity of the studied virus was unknown. We suggested that rhubarb mosaic virus (RMV) was a strain of cabbage black ringspot virus (group of turnip mosaic virus 1), according to the host plants and the physical dates. Further studies on host plants and serological relationship proved that RMV was not identical with cabbage black ringspot virus. Therefore we propose for RMV the name *Rheum* virus 1 or *Marmor rhei.* Lately, evidence has been obtained by serological test (Schade, 1959) that rhubarb is a spontaneous host plant of turnip mosaic virus. This isolate from rhubarb differs in certain characteristics from the original cabbage black ringspot virus.

KLOTZ, L. J., and T. A. DEWOLFE. University of California. *Studies on Phytophthora Root Rot of Citrus.* Destruction of the fibrous feeder roots by micro-organisms is a major factor in the deterioration in health and productivity of citrus trees. Two fungi, *Phytophthora parasitica* and *P. citrophthora* have been found to be important root destroyers. Their parasitism is favored by excessive amounts of water, organic matter, ammonium sulfate, and urea. Optimum temperature for growth of *P. parasitica* is near 32°C.; for *P. citrophthora,* 26°C. Parasitism is influenced by temperature, *P. parasitica* doing most damage during spring and summer and *P. citrophthora* in fall and winter. Of 30 varieties of rootstock seedlings tested for resistance to these fungi the Ichang pummelo and Argentine and New Mexican varieties of trifoliate orange showed a promising degree of resistance. These were capable also of regenerating roots rapidly. Until such rootstocks can be grown in quantity the more susceptible varieties now in use can be protected by disinfesting seedbeds, nursery, and planting sites with Vapam or Mylone and irrigation water with chlorine. Without impairing their germination citrus seed can be freed of these fungi by immersion in water at 49°–52°C. for 5 minutes. Seedling roots may be disinfected of *P. citrophthora* by immersion in water at 48°C.; this was insufficient to kill oospores of *P. parasitica*. The latter species in a one-inch layer of soil, which was raked once a day, survived the soil heat (36°C., maximum) and drying of 14 days summer sunlight; however, *P. citrophthora* was killed by this treatment.

Knapp, E. Max-Planck-Institut für Züchtungsforschung, Rosenhof, Germany. *Meiotic Segregation in Green Plants.* A brief survey of tetrad analysis of Phanerogams, Bryophytae, and algae for studying the segregation of chromosomal genetic structures will be followed by a more detailed discussion of tetrad analyses in *Sphaerocarpus*. In *Sphaerocarpus* the centromere always undergoes prereduction (first-division segregation). The different loci on the chromosome show different frequencies of post-reduction (second-division segregation), according to the frequency of recombination between the centromere and the locus in question. Very high frequencies of second-division segregations (more than 90 per cent) for some loci indicated localized crossovers between the centromere and the specified locus. The occurrence of chromatid and chromosome interference will be discussed. Reitberger's caryological investigations of the meiosis will be mentioned: notwithstanding clear genetic recombination, bivalents without contact between the two homologous chromosomes were found in diakinesis. Finally "gene-conversion" in green plants will be mentioned.

Knight, Robert J., Jr. U.S. Department of Agriculture. *Compatibility Relations in the Convolvulaceae. Ipomoea pandurata*, a wild morning-glory, was found to be self-incompatible. Other species were then examined in a survey of *Convolvulaceae*. When selfed flowers set seed, a species was designated as self-compatible. Conversely, failure of pollen set with apparently normal self pollen designated a plant self-incompatible. The following 15 species proved self-compatible: *Calonyction aculeatum, C. muricatum, Quamoclit coccinea, Q. lobata, Q. pennata, Ipomoea fistulosa, I. hederacea, I. lacunosa, I lindheimeri, I. nil, I. purpurea, I. setosa, I. trichocarpa, I. tricolor, and I. triloba.* Nine self-incompatible species were *Ipomoea cairica, I. cathartica, I. pandurata, I. tyrianthina, I.* sp. (from El Papayo, Mexico), *Jacquemontia martii, Merremia tuberosa, Convolvulus arvensis,* and *Calystegia sepium.* Intraspecific crosses within *Ipomoea nil, I. pandurata, I.* sp. (El Papayo), and *Calystegia sepium* were studied. All combinations within *Ipomoea nil* set seed. Results within the other species varied. Pollen reaction on stigmas or in styles – following self- or cross-pollination – was determined in several cases as an additional test. Pollen of *I. purpurea* germinated on stigmas of *I. hederacea*, but was inhibited before tubes penetrated the style. (Taxa have been reported as natural hybrids between these two species.) Self-incompatibility of *I. pandurata*, restricting seed set, may explain its greater scarcity than three sympatric self-fertile species.

Knight, S. G., R. F. Gehrig, and C. W. Haidle. University of Wisconsin. *Conversion of Fatty Acids to Methyl Ketones by Spores of Penicillium roqueforti. Penicillium roqueforti* is noted for its ability to convert specific fatty acids to methyl ketones that are one carbon atom (the carboxyl carbon) shorter than the parent fatty acid. During a study of the kinetics of this conversion, it was discovered that the conversion of the fatty acid to the ketone was done by the spores of the mold and that the vegetative cells are completely lacking in the ability to catalyze this unique reaction. The reaction is stimulated by magnesium and phosphate ions and is completely dependent upon oxygen; maximum activity is at pH 6 and activity is about 15 per cent at pH 5.5 and pH 7.5. The reaction requires free sulfhydryl groups and is insensitive to cyanide, azide, and carbon monoxide. The enzyme system involved is very stable and a single batch of spores has been kept converting continuously for a month. The spores do not germinate during the conversion and if a source of carbohydrate and nitrogen suitable for germination is provided the conversion stops prior to emergence of the germ tube. The enzymology of this conversion bears a close resemblance to the oxidation and hydroxylation of drugs by liver microsomes and certain other fungi.

Koch, William J. University of North Carolina. *The Motile Cell of Uniflagellate Phycomycetes.* Within the body of the flagellated cell, a functional and non-functional blepharoplast, rhizoplast, nucleus, nuclear cap, side body, side granules, lipoid bodies, and vacuoles may be identified. In the Chytridiales their presence or absence and their appearances, along with the symmetry or arrangements of the internal parts, are variable enough to serve as a basis for critical taxonomic comparisons. In some isolates the size and number of the lipoid bodies and the position of the blepharoplast, as well as body size and shape, may be varied experimentally. Details of structure in the chytrid flagellum, blepharoplast, and rhizoplast suggest certain homologies with bacteria. The double image of the active flagellum may be variously asymmetrical in all species, but one basic pattern of symmetry is detected. There are slight indications that flagellar action may be three-dimensional rather than just two-dimensional. One fundamental mode of swimming is recognized. In most species, prior to the encystment of the zoospore, the flagellum is active and takes part in its withdrawal, which is effected in either of two ways. Certain observations of the position of attachment and action of the flagellum and the shape and internal structure of the spore body permit phylogenetic speculation.

Koffler, Henry. Purdue University, Indiana. *The Molecular Basis of Cellular Adaptation to High Temperatures.* The ability of thermophilic organisms to grow at relatively high temperatures can be explained at least partially by the stability of their cellular constituents. For example, proteins isolated from thermophiles are strikingly more heat stable than similar preparations from mesophiles (H. Koffler, Bact. Revs. *21*, 227-240, 1957). That this stability is influenced by the temperatures of growth can be illustrated by the following observations. Cells of *Bacillus coagulans*, strain 43P., and *Bacillus sp.*, strain 2184, were grown at 26° and 55°C., and 40° and 65°C., respectively. Proteins and polymers of proteins isolated in highly purified condition from organisms grown at the upper limit of their growth range are much more stable than isolates obtained from cultures grown at the lower growth temperatures. The possibility that each population consists of a mixture of cells some of which can grow only at the higher temperature (and produce relatively stable proteins), and others capable of growing at the lower temperature (and forming relatively labile proteins), was examined. The data indicate that this possibility is unlikely, and that the cells of the same type are indeed able to synthesize relatively stable or labile proteins or aggregates of protein, dependent upon the temperature at which the cells were grown. The properties of these cellular components will be described, and explanations regarding adaptability on the molecular level will be attempted.

KOK, BESSEL. Research Institute for Advanced Studies, Baltimore. *Significance of the 705 mu Absorption Change in Photosynthesis.* Earlier we described the occurrence of a reversible light-induced decrease of absorption on the long wavelength side of the chlorophyll *a* absorption peak. The effect was found universally in chlorophyll *a* containing plants. A considerably improved technique has been developed, which allows the observation of quickly reversible changes in addition to "background" absorption shifts characterised by slow rise and decay times. An analysis of the phenomena observed in the red and far-red part of the spectrum reveals characteristic and peculiar changes of pigments under the influence of illumination. Some of these effects will be discussed in their relation to other aspects of the photosynthetic process.

KOMAROV, V. L. *See* ZALENSKY, O. V.

KONAREV, V. G. Academy of Sciences, Ufa, U.S.S.R. *Nucleic Acids and Plant Morphogenesis.* The modern knowledge of nucleic acids is based mainly on the results of study with heterotrophic organisms. This has influenced the idea about the role of nucleic acids in morphogenesis. It is often considered that nucleic acids bear a direct relation only to morphogenesis because they are connected with protein structure. The question arises, what is the role of nucleic acids in higher plants which possess substances of non-protein structure. The author has found a connection between nucleic acids and the formation of corn starches and secondary thickening in cell walls of vessels, mechanical elements, and epidermis. These processes are preceded by ribonucleic acid accumulation in cytoplasm and ribonucleic acid concentration in the places where secondary membrane or corn starches are laid down at the earliest stage of cell differentiation. There is a connection between ribonucleic acid and cell-wall regeneration at the plasmolysed protoplasts. It was shown that resin production from the pine tree is connected with desoxyribonucleic acid state. The author concludes that the nucleic acids of higher plants participate in the realization both of functions common to all organisms and of functions characteristic of plants only. Common functions are the functions during the earliest stages of ontogenesis such as the division and growth of cells, the formation of cytoplasmic and nuclear structures, and protein synthesis. Functions characteristic of plants are the following: the formation of specialized structures and metabolites of non-protein nature at the stage of morphological cell differentiation. The participation of nucleic acids in these processes is the result of the peculiarity of historically formed metabolism and morphogenesis which are connected with autotrophic nourishment of plants.

KONAREV, V. G., S. Z. ZAKIROV, T. N. ELSAKOVA, A. F. POLOVYANYUK, and I. F. CHEKMIN. Academy of Sciences, Ufa, U.S.S.R. *The State of Desoxyribonucleic Acid in the Nucleus and Age Changes in the Plant Cell.* Histochemical and spectrophotometric research shows that methyl green stains nuclei when desoxyribonucleic acid (DNA) is highly polymeric and connected with protein by amino groups or other connections such as hydrogen bonds. Pyronin stains nuclei in which the DNA is partially degraded and weakly connected with protein. The relation of nuclei to methyl green in the ontogenesis of the plant cell changes from the phase of embryonic growth to the phase of differentiation. During aging, nuclei lose the ability of adsorbing this dye and become pyroninophyllic. Nuclear pyroninophyllia of all the cells arises when plants starve and it may be due to the effect of different agents on tissue (acids, solutions, salts, high temperature, ultraviolet rays, etc.). The behavior of the cell nucleus towards pyronin and methyl green as an index of the state of DNA and the manner of its connection with protein may be used for the estimation of the age and functional changes of tissues and a plant itself.

Konishi, Kenji. University of Tokyo. *Geologic Records of Paleozoic Codiaceae.* Genera of Codiaceae flourished during the Paleozoic Era, and perhaps much knowledge about the history of the family can be gained from analyses of the Paleozoic occurrences. Geologic distribution of Codiaceae indicates that their evolutionary trend is characterized by a gradual expansion after the Ordovician, a climatic peak during the Carboniferous, and a weak terminal during the Permian. A second, smaller peak obtained during the Jurassic. A probable directional evolution is well exemplified by the linkage of the Carboniferous Udoteae, *Calcifolium*→*Ivanovia*→*Anchicodium.* Paleophytogeographic surveys of Codiaceae for each period of the Paleozoic Era suggest that climatic zonation during most of the era was significantly different from that of Recent time; however, a drastic change occurred in Early Permian and resulted in a climatic zonation quite similar to the present one. Three morphologic suites can be distinguished among the Paleozoic Codiaceae: one is strictly a fossil taxon, rather doubtfully referable to the Codiaceae; and the others are fossil correlatives of Recent genera such as *Halimeda* and *Udotea*, respectively. Based on these suites, fossil Codiaceae can be classified into two subfamilies, one of which is further divided into two tribes.

Konovalov, I. N., R. I. Lerman, E. N. Mikhaleva, A. I. Smetannikova, and N. V. Shilova. Academy of Sciences, Moscow. *Peculiarities of the Changes of Physiological Processes in Plants Correlated with Frost Hardiness.* This investigation was devoted to the peculiar changes in photosynthesis, carbohydrate content, and thermal stability of proteins, as well as the changes in the oxidation-reduction processes and water relations. The plants studied were *Juglans regia* L., *Thea sinensis* L., and *Medicago sativa* L. The physiological processes were studied during both the vegetative period and the period of dormancy. The following differences between the frost-hardy and non-hardy plants have been observed. (1) Diurnal and seasonal variations of photosynthesis: in frost-hardy plants the intense assimilation of carbon-dioxide begins earlier in the morning, whereas in non-hardy plants it requires higher air temperatures and consequently begins later in the morning; this difference is particularly conspicuous at the beginning and end of the vegetative period, which apparently indicates a higher sensitivity of non-hardy plants to temperature contrasts. (2) Carbohydrate metabolism: frost-hardy plants are characterized by a higher content of hemicellulose and water-soluble carbohydrates (glucose in autumn and saccharose in winter). (3) Thermal stability of the proteins: frost-hardy plants are characterized by a higher thermal stability. (4) Oxidation-reduction processes: in frost-hardy plants these processes are more intense. (5) Water relations: frost-hardy plants are characterized by a higher water content during the period of intense growth. By the end of the vegetative period the water content is reduced, mainly at the expense of the non-bound water; this reduction of the water content is particularly conspicuous in frost-hardy plants; apparently frost-hardiness is to a certain extent dependent on the proportion of the bound and the non-bound water in the total water content. Frost-hardy arboreous plants are characterized by some peculiar morphological features: as a rule shorter shoots which complete their growth earlier in the season are especially frost-hardy, and prevail in frost-hardy arboreous plants. In non-hardy arboreous plants, the shoots are long and continue their growth until late autumn. Thus, the frost hardiness of plants is to a considerable extent associated with certain peculiarities of the shoot growth during the vegetative period of the previous year.

KONOVALOV, I. N. *See* BELJDENKOVA, A. F.

KORN, ROBERT W. Indiana University. *Ultraviolet-induced Morphological Mutations in Cosmarium turpinii Bréb.* A heterothallic strain of *Cosmarium turpinii* Bréb. was subjected to ultraviolet radiation for the purpose of studying morphological variations in a bilaterally symmetrical desmid. To date six "mutants" have been isolated and successfully cultured. These exhibit either (1) an alteration of the symmetry pattern, or (2) a change of cell shape without a change of symmetry pattern. Four mutants represent changes in the symmetry of the cell as observed from end view. One is triangular and termed a triradiate; a second is square in end view and called a quadriradiate; a third is asymmetrical, having one lobe and called uniradiate; and the fourth is nearly circular in end view and is termed a nullradiate. Growth rates, pore patterns, volume/surface area relationships, stability characteristics, and mating behavior have been analyzed for each. Diploids of the four mutants and normal type have also been studied. A study of the production and inheritance of mutations in *C. turpinii* is being continued.

KORCZAGIN, A. A. Academy of Sciences, Leningrad. *Various Forms of Plant Interrelations in Plant Communities.* The complexity of plant interrelations on the one hand and the relationships between the plant and the abiotic factors, animals, and man on the other hand are characteristic features of any plant community. Plant interrelations can be classified into three groups: (I) The direct environt-forming influence of some plants on others. This type of interrelation is universal, and the most important one. Each plant specifically changes its environment, which frequently results in a state of conflict between it and the surrounding plants, because the changes in the environment produced by any plants usually do not meet the requirements of other plants. Consequently the interrelations between plants can be: (1) mutually disadvantageous (competition), resulting in mutual suppression when the means of subsistence are not sufficient for all the plants; (2) unilaterally disadvantageous, leading to unilateral suppression of some plants. In addition, beneficial interrelations, both mutual and unilateral, are also produced in plant communities when the changes produced in the environment by some plants prove to be favourable for some other plants. (II) The direct contact interrelations of plants: (1) symbiotic (s.str.), (2) parasitic, (3) epiphytic, (4) mechanical, (5) physiological (natural grafting of roots, etc.). (III) The direct influence of some plants upon other plants via the environment: (1) the biological influence (cross-pollination); (2) the biochemical influence (by the excretion of liquid and volatile fractions of certain biochemical compounds; their significance in the life of plant communities is as yet but little studied). All these forms of interrelations occur in any plant community, but the most important is the indirect environt-forming influence of plants on other plants, especially competition, the other forms prevailing only on rare occasions.

Korovin, Evgeny Petrovych. V. I. Lenin Central Asia State University in Tashkent, U.S.S.R. *On the Significance of Biogenic Factors in the Vegetation Development of the Arid Zone.* The predominance of the abiotic phenomena over the biotic in the physico-geographical processes of the arid zone is generally recognized in the literature. The biogeochemical ideas of academician V. I. Vernadsky have induced investigators to revise this view. Lately, in the U.S.S.R., a number of researches in the field of pedology and geobotany have suggested that the phytocenoses operate as a special transformer of material and energy, influencing the development of natural phenomena in the desert. The significance of the vegetation, its "pressure" on the physico-chemical medium, generally depends on the dimension of the mass produced and on the character of its action (chemical composition of the plant, peculiarities of its transformation). In the arid zone, a geochemically expressed type of plant-salt accumulators is detected. Plants selectively extract from the soil and accumulate in their body ions of Ca, Na, Mg, SO_4, and Cl, much in excess of their contents in the plants of other zones (T. A. Gavelson, 1934; M. M. Shukyevich, 1939; V. A. Kovda, 1944; E. P. Korovin and S. A. Shuvalov, 1948). Redeposited every year in the soil, they alter it, and thereby cause a change of phytocenosis. The typical complexity of plant formations in the arid zone is in many cases conditioned by biogenic causes. Thus, the significance of the "geochemical function" has been shown for Cyanophyceae and lichens in the desert takyrs (N.J. Bazylevich and L. E. Rodin, 1956). Great successions arise on the desert zone sands under the influence of mosses and angiosperms (V. L. Dubyansky, 1928; E. P. Korovin, 1953; L. E. Rodin, 1958). The same influences are perceptible in the changes of tugays vegetation (gallery forests). These facts and first general conclusions introduce a correction into the old views about the development of plantings in arid zones which would not take into consideration the consequences of the organism's vital activity. At the same time they corroborate the ideas of academicians V. I. Vernadsky (1863-1945) and V. R. Williams (1863-1939).

Kosanke, Robert M. Illinois Geological Survey and University of Illinois. *Late Paleozoic Small Spore Floras of United States.* Pennsylvanian small spore floras of United States are fairly well reported in the literature, and additional data are being supplied at regular intervals. Reports on Mississippian and Permian small spore floras are needed to fill the gaps in our knowledge and for comparisons of Mississippian-Pennsylvanian and Pennsylvanian-Permian boundaries. When these data are available it will be possible to delineate more accurately the Late Paleozoic stratigraphic ranges so that comparisons may be made throughout the world. Interest is increasing in studies of Permian coal beds from Eastern United States and shale samples from Western United States. Within the Eastern Interior Basin, the Chester Series (Upper Mississippian) contains two coal beds that appear to have lateral continuity as well as a number of clastic formations or members that contain thin coals or coaly horizons. Five of these coal beds of early, middle, and late Chester time have been examined in sufficient detail to allow plotting of the data for comparisons with already published data.

KOSANKE, ROBERT M. *See* TSCHUDY, ROBERT H.

KOSTROWICKA, MARIA. Cambridge, England. *Interaction between Phytophthora infestans and Rhizoctonia solani. Phytophthora infestans* growing on the cut surface of a potato tuber was overgrown and eventually destroyed by *Rhizoctonia solani*, which was already present as sclerotia on the skin of the tuber. Tuber tissue in the invaded area was decaying and *Phytophthora* mycelium discolored. Microscopic investigations, at this stage, revealed the distraction of cytoplasm in *Phytophthora* aerial mycelium, abnormal growth of its hyphae in the tuber tissue, and the intense invasion of the parenchymatic tissue by *Rhizoctonia*. Later *Rhizoctonia* formed "black scurfs" (covered with drops of exudate), which grew thicker with the progressing decay of the tuber tissue until it was completely destroyed after three to four weeks. Brown *Rhizoctonia* exudate added to a hanging drop of *Phytophthora* suspension of zoospores dissolved their membranes. *Phytophthora*, which was itself destroyed, obviously stimulated the growth of *Rhizoctonia*, which alone could neither grow inside the tuber tissue nor destroy it. Similar type of interaction between the two fungi was found in cultural studies. *Phytophthora infestans* grown in French's liquid medium inoculated with *Rhizoctonia solani* was devoid of cytoplasm after five days, and after 13 days no trace of *Phytophthora* remained. Further cultural investigations confirmed that the substance produced by *Rhizoctonia solani* was toxic to *Phytophthora infestans*.

KOSUGE, T., and ERIC E. CONN. University of California. *The Metabolism of Coumarin and o-coumaric Acid in White Sweet Clover.* The metabolism of coumarin and *o*-coumaric acid in white sweet clover (*Melilotus alba*) has been investigated by isotopic tracer techniques. In these experiments, radioactive compounds were administered to shoots excised from mature sweet clover plants. After 28 hours, the plant material was extracted and the radioactive metabolites which arose from the administered compounds were isolated and identified. Under these conditions, melilotic acid (*o*-hydroxyhydrocinnamic acid) accounted for 35 per cent, and the β-glucoside of melilotic acid 12 per cent, of the activity administered as coumarin-3-C^{14}. Under the same experimental conditions, *o*-coumaric acid-2-C^{14} was readily converted to the β-glucoside of *o*-coumaric acid. The conversion of coumarin to melilotic acid has been demonstrated in experiments utilizing cell-free extracts from mature sweet clover plants.

KOYAMA, TETSUO. University of Tokyo and University of the Ryukyus. *Geographical Distribution of the Japanese Species of the Genus Carex.* Having a vast population distributed in various fairly distinct kinds of areas, the genus *Carex* is interesting from a phytogeographical point of view. However, owing to technical difficulties, there has been no account of *Carex* illustrating its distribution patterns, except for Mr. Raymond's work (1951) in which Canadian materials were dealt with. In Japan, *Carex* is represented by 288 species geographically grouped into the 15 types of distribution: (1) Arctic species; (2)

Arctic-Alpine species; (3) Alpine species; (4) Boreal species: (*a*) Circum-boreal species, (*b*) Eurasiatic species, (*c*) Japono-American species, (*d*) Boreal halophytes; (5) Asiatic species: (*a*) Siberio-Manchurian species, (*b*) low Northern Chinese species, (*c*) low Central Chinese species, (*d*) Chino-Himalayan species, (*e*) Indo-Malaysian species, (*f*) Eastern-Asiatic halophytes, (*g*) Asiatic species reaching to Australia, (*h*) strict Japanese species. The author will try to interpret the degree of specific differentiation of each pattern, showing each area by slides.

KOYAMA, TETSUO. University of Tokyo and University of the Ryukyus. *Studies of the Flora of Japan and Its Surrounding Regions.* A historical survey of the flora of Japan and its neighbouring regions will be given. The flora of Japan is well known as a result of numerous investigations which may be grouped into three periods on a historical basis. The first contains the so-called classical studies, including those of Thunberg, Siebold, Franchet and Savatier, and Maximowicz. Makino's are the most recent in this group. The second group is comprised of various monographs on eastern Asiatic flora, contributed by many specialists since about 1930. Among them are those of Nakai, Koidzumi, Honda, Ohwi, Ito, Maekawa, Hara, Kitamura, Takawa, and Y. Kimura. These in turn led to the modern complete accounts such as Ohwi's and Hara's. The former will appear in English. The third group is comprised of the recent phytogeographical studies of Hara and Kanai. Floras outside Japan still need investigation. However, there are some floristic treatments available for these regions, such as those of: Hayata (Formosa); Walker, Hatusima (Ryukyus); Nakai (Korea); Komarov, Kitagawa (Manchuria); Maximowicz, Schmidt (Amurland); Miyabe and Kudo (Saghalien, Kuriles); Tatewaki (Kuriles); Komarov, Hultén (Kamchatka).

KOZLOWSKA, ANIELA. Krakow, Poland. *Relation between Respiration Rate in Tobacco Leaves and Susceptibility to the Infection by Potato Virus X.* The experiments were performed on tobacco seedlings cultivated on (1) complete nitrate nutrient, (2) complete ammonium nutrient, (3) nitrate nutrient deficient in SO_4, and (4) ammonium nutrient deficient in SO_4. In the 5-leaf state the leaves were inoculated with the infectious juice of potato virus X (strain S). Five days after inoculation the average number of local lesions/cm.^{2} produced on those leaves was counted. In complete nitrate nutrient the susceptibility of tobacco seedlings to infection by potato virus X attained its optimum. The respiration rate was very high. On complete ammonium nutrient the infection was about three times weaker and respiration rate fell. Tobacco seedlings cultivated on nutrient deprived of SO_4 ions showed a drop in their susceptibility to infection. Addition of cystein to the complete nutrient increased free amino acid content in tobacco leaves, but decreased susceptibility to infection and intensity of respiration. In the nutrient deficient in SO_4, cystein caused an increase in infection. When inoculated leaves were transferred from the ammonium to the nitrate nutrient, cystein caused inhibition of the virus X infection. In this case the intensity of respiration was extremely low. The relation of respiration rate, amino acid and organic acid content, and virus infection in potato and tobacco plants is discussed.

KOZLOWSKI, THEODORE T. University of Wisconsin. *Water Movement in Trees.* Various aspects of water transport are reviewed including upward movement, lateral movement in injured trees, internal redistributions as related to competition between leaves and fruits and between branches, downward transport under special conditions, and transport through root grafts. Particular emphasis is given to review of ascent of sap. The root pressure, vital cohesion, and alternative theories are considered. Commonly raised objections to cohesion theory are reviewed including the impossibility of tensive channels existing in the presence of free air bubbles, the inadequacy of the tensile strength of water, the failure of stem pressures to decrease proportionally with the increase in height, insufficient evidence for existence of continuous water columns, and the likelihood of ready fracture of water columns. Some of these objections are questioned by recent work, but in some aspects the cohesion theory still needs definitive experimental support.

KOZUKA, Y. *See* KURABAYASHI, M., *et al.*

KRAJINA, VLADIMIR J. University of British Columbia. *Can We Find a Common Platform for the Different Schools of Forest Type Classification?* Forests may be synecologically classified at three levels: (1) Environmental (habitat) or ecotopical level: the main interest lies in the controlling characteristics of the ecotope of forest parts. Such studies are directed either to macroclimatic differentiation (climatopic approach), or to soil characteristics (edaphotopic approach). (2) Biocoenotic level: biocoenoses are studied analytically and synthetically in their qualitative and quantitative composition. These studies are dominated by either a phytocoenotic or zoocoenotic approach. (3) Ecosystematic or biogeocoenotic (holocoenotic) level encompasses both previous levels. The successful synecological classification depends on the ecosystematic foundations in the sense of Sukachev's biogeocoenoses, the phytocoenosis of which is the plant association as mainly interpreted by Braun-Blanquet. A more complete definition of this fundamental phytocoenosis is as follows. A plant (forest) association is a definite uniform phytocoenosis which is in dynamic equilibrium with a complex of environmental factors (ecotope). Its floristic structure—that is, stratification, species significance (abundance and dominance), sociability, constancy, fidelity, and vigour of the component species—lies within limits governed not only by the ecotope (climate, soil, substratum, topography, and biotic environmental factors), but also by the historical factors of the vegetational development (the fourth dimension or space-time factor).

KRAJINA, VLADIMIR J., W. F. MURISON, and J. G. N. DAVIDSON. University of British Columbia. *Limiting Edaphic Factors Evidenced by Deficiency Symptoms of Some Conifers.* Nutrient deficiencies, acting as limiting habitat factors that are basic ecological elements, may be distinguished by the symptoms they cause. Sand culture experiments with certain coniferous species over a period of years have furnished evidence on the symptoms of phosphorus, nitrogen, magnesium, calcium, and potassium deficiencies. Species studied were *Pseudotsuga menziesii* var. *menziesii* and var. *glauca, Tsuga heterophylla, Picea sitchensis, P. engelmannii, Abies amabilis, A. grandis, Pinus monticola, P. ponderosa,* and *Thuja plicata.* From studies carried out concurrently on even-aged individuals of different tree species, generic and specific differences, expressed by the onset and severity of deficiency symptoms, may lead to the discovery of some edaphic requirements of the tree species.

KRAJINA, VLADIMIR J. *See* SZCZAWINSKI, ADAM F.

KRALL, A. R., and O. v. H. OWENS. RIAS, Inc., Baltimore. *Enzymic Reactions Intermediate in Photophosphorylation.* A phosphate-binding protein has been demonstrated in non-green extracts of washed chloroplasts. The protein has been partially purified by column chromatography. The phosphate-containing protein can be isolated from chloroplasts under conditions such that its formation appears to be the first step in phosphate transfer to adenosine diphosphate (ADP). A phosphate ester previously found in leaves immediately after a bright flash of light has now been isolated in large amounts from phosphorylating chloroplasts. Its kinetic behaviour is that of a precursor to adenosine triphosphate (ATP). Finally, acceptor behaviour of the ADP-kinase enzyme is being studied, using the coupled reduction of ferricyanide as an assay. Only the purine dinucleotides stimulate reduction, in line with our earlier finding that all purine dinucleotides were direct acceptors of phosphate. It is our belief that the phosphate ester isolated is a reductant as well as a high energy ester. On this basis, an attempt to explain coupling of the Hill reaction and phosphorylation will be made. (Supported in part by RG-5583 from the Division of Research Grants, U.S. Public Health Service.)

KRAMER, C. L. *See* PADY, S. M.

KRAMER, PAUL J. Duke University, North Carolina. *Radial Movement of Salt in Roots.* Experiments with radioactive tracers indicate that ions enter roots and move to the shoot most rapidly in the same region through which most water enters. Ions may move along the water-saturated cell walls, through the cytoplasm which is connected by plasmodesms to form the symplast, and from vacuole to vacuole. Movement from vacuole to vacuole seems least likely. Inward movement of salt from the epidermis to the xylem might occur by active transport, diffusion, and mass movement in the transpiration stream. Some sort of active transport mechanism occurs, resulting in the accumulation of salt in the xylem sap, but the mechanism involved is not understood. There is no barrier to inward movement by diffusion at least as far as the endodermis, and if ions can move by diffusion they also can be carried by mass flow in the transpiration stream. Active transport undoubtedly plays an important role in salt movement into roots, especially young roots, but it is believed that considerable passive movement by diffusion and mass flow also occurs, especially in older roots and rapidly transpiring plants. Regardless of whether salt moves actively or passively its movement will be affected by the condition of the cytoplasm through which it must pass. Temperature, aeration, and respiratory inhibitors affect passive water movement by modifying the filtration resistance of roots, and they will also affect passive movement of ions carried in the water, in addition to affecting the active transport mechanism.

KRAMER, PAUL J. Duke University, North Carolina. *Tree Physiology in Relation to Forestry Research.* Foresters are concerned primarily with research which will aid them in growing stands of trees more efficiently, while physiologists are concerned principally with study of the processes which control growth. Effective solution of the numerous problems connected with growing trees requires a much greater knowledge of the physiological processes which control tree growth than we now possess. A knowledge of tree physiology is necessary for the development of sound silvicultural practices because the only way in which environmental factors and cultural treatments can modify tree growth is by affecting internal physiological processes and conditions. A tree is a complex organism which synthesizes foods from carbon dioxide, water, and certain mineral nutrients and converts them into wood. Silvicultural practices should be designed to enable the physiological processes to operate at the highest possible efficiency. This is possible, however, only if the effects of environmental factors and silvicultural treatments on processes are well understood. Unfavorable conditions such as saturated or dry soil, lack of mineral nutrients, and excessive shade reduce growth by reducing the rates of various essential physiological processes. Insects and diseases reduce growth only to the extent that they interfere with processes. Thinning and other silvicultural treatments increase growth only if they increase the rates of processes favorable for growth. Thus, a good understanding of tree physiology is essential to planning and evaluating research in applied forestry.

KRAPOVICKAS, ANTONIO. Instituto Lillo, Tucuman, Argentina. *Cromosomas y Evolución en Malveae.* El numero de cromosomas es una buena base para establecer relaciones filogenéticas en la familia de las Malváceas. En este trabajo se analiza la relacion entre el numero cromosómico y caracteres morfologicos de flor y fruto de los géneros de la tribu *Malveae,* pudiendo establecer varios grupos bastante bien definidos. Se pone en evidencia la gran afinidad existente entre los géneros *Sphaeralcea, Tarasa, Nototriche, Eremalche, Monteiroa, Urocarpidium, Modiola* y *Modiolastrum,* todos ellos pertenecientes a una sola línea evolutiva caracterizada por tener $x = 5$, siendo presumiblemente *Sphaeralcea* el género más antigue. Se analizan los sistemas de división en subtribus de la tribu *Malveae* y se discute su validez, teniendo en cuenta que los géneros derivados de *Sphaeralcea* figuraban hasta ahora ubicados en diferentes subtribus.

KRASNOVSKY, A. A. Academy of Sciences, Moscow. *Photochemistry of Chlorophyll and the State of Pigments in Photosynthesizing Organisms.* From studies of the photochemical properties of pigments, we found that the excited molecules of chlorophyll, its analogues, and derivatives (having the structure of porphin, chlorin, and bacteriochlorin) undergo reversible photoreduction, that is, transfer of an electron (hydrogen) from a donor molecule, accompanied by the formation of active photoproducts, and storage of the energy of light quanta. It was shown that the capacity to undergo reversible photoreduction determines the photosensitizing action of chlorophyll and its analogues in reactions of photochemical hydrogen (electron) transfer in solutions, from donor molecules (ascorbic acid, cystein, etc.) to acceptors (oxygen, flavines, pyridine nucleotides, etc.). The study of the state of pigments in organisms from the phylogenetic point of view revealed that the main bulk of bacteriochlorophyll and bacterioviridin in purple and green bacteria accumulate in aggregated structures. Probably a part of the chlorophyll in plants exists in monomeric forms, bound with lipids and proteins. In the course of chlorophyll biosynthesis in etiolated and green plants, the intermediate "active" protochlorophyll and chlorophyll are formed. The data given above speak in favour of the working hypothesis that chlorophyll and bacteriochlorophyll participate in photosynthetic electron (hydrogen) transfer linked with the enzymic stages of the photosynthesis.

Krassilnikov, N. A. Academy of Sciences, Moscow. *Influence of Certain Bacteria on Accumulation of Vitamins and Amino Acids in Plant Tissues.* (1) Experiments have shown that numerous soil microbe-activators, especially those developing in large numbers in the region of roots (in rhizosphere), often exhibit an influence on growth and development of plants. Such microbe-activators stimulate growth and increase yield of dry-weight matter of plants. They appear to be an important factor causing an increase in yield of crops in general. (2) Further experiments have demonstrated that microbe-activators primarily influence plant growth with their metabolic products, that is, with their biologically active substances. Such substances differ in their chemical nature and biological action on plants. Here belong: auxins, vitamins, amino acids, gibberellins, gibberellin-like compounds, and various other growth substances. All these substances are absorbed by the roots of plants from soil, and upon entering the plant tissues redistribute themselves more or less equally. (3) Microbe-activators bring about notable changes in the composition of amino acids and some vitamins in plant tissues. We were able to demonstrate the presence of vitamins in tissues of peas, beans, alfalfa, and also in tissues of corn and wheat, all of which grew in the presence and absence of bacteria. Very notable increases in the content of amino acids were observed in the tissues of leguminous and non-leguminous plants grown in associations of the root-nodule bacteria and certain strains of the genus *Pseudomonas* (*Ps. fluorescens*). *Azotobacter* showed little influence or none at all. Some bacteria showed a negative influence on formation and accumulation of amino acids. (4) Our experiments have demonstrated great variations in accumulation of vitamins (B_1, B_2, and biotin) in the tissues of corn and wheat under the influence of the appropriate cultures of soil bacteria. Noticeable increases in B_1 vitamin and biotin appeared in the tissues of wheat under the influence of *Pseudomonas aurantica,* smaller under the influence of *Azotobacter,* and no increases at all were observed under the influence of the root-nodule bacteria of clover. Cultures of spore-forming bacteria, *Bacillus mycoides,* and some strains of non-spore-forming bacteria caused a decrease in the content of vitamins. The substances produced by *Pseudomonas denitrificans, Azotobacter chroococcum* strain No. 12, and *Actinomyces griseus* strain No. 52, show some influence on accumulation of vitamin B_2 in tissues of wheat and corn. (5) By experiments performed on assimilation of phosphorus from soils, it was demonstrated that certain bacteria belonging to groups of *Pseudomonas* and *Azotobacter* exhibit active properties as well. Under their influence inorganic phosphorus is taken up from soil more rapidly and turned into an organic phosphorus in plant tissues. (6) We believe that soil micro-organisms with their activating properties not only speed up growth of plants and bring about increases in yield of their green matter, but also improve quality of the yields.

Kräusel, R. Forschungsinstitut Senckenberg und Universität Frankfurt. *Die Permfloren der Südhalbkugel und ihre Beziehungen zu anderen Floren.*

Kreisher, John H. *See* McClendon, John H.

Kremp, G. O. W. The Pennsylvania State University. *Can Expanding Palynology Escape Taxonomic Chaos?* Recognition of the importance of information obtained from the study of fossil spores and pollen has resulted in a tremendous expansion of effort in this area of research during the last decade. However, the number of descriptions of new species is mounting with such speed that all signs indicate that palynology is drifting very rapidly in the direction of taxonomic chaos, a situation in which foraminiferal micropaleontologists are already suffering. Some possibilities for avoiding such a dangerous trend are discussed: cultivation of more intensified international cooperation; increasing of the efficiency of the International Code of Botanical Nomenclature; cataloguing of the names and descriptions of species and genera of fossil spores and pollen; creation of coding systems for a morphological arrangement of fossil spores and pollen species; and development of a dictionary of morphological terms giving the interpretation of various palynologists.

KREMP, G. O. W. *See* FREDERIKSEN, N. O.

KRETOVICH, W. L., and V. I. YAKOVLEVA. Academy of Sciences, Moscow. *Biosynthesis of Glutamic Acid and Glutamine in the Living Plant.* We studied the transformations of amino acids in the green sprouts of wheat and pea and in the developing wheat ears, into which potassium or ammonium salts of α-ketoglutaric acid had been introduced. These substances were introduced into the living plants by means of vacuum infiltration or suction with the transpiration flow. Our experiments were carried on with the help of quantitative paper chromatography. An intense synthesis of glutamic acid takes place after the introduction of both salts of α-ketoglutaric acid. The introduction of α-ketoglutarate is accompanied by the expenditure of glutamine, which participates in the transamination with α-ketoglutaric acid. Thus, the transamination in the living plant tissue differs greatly from the transamination in the homogenates where aspartic acid and serine first of all participate in the process of transamination with α-ketoglutarate. Besides the synthesis of glutamic acid, the introduction of ammonium-α-ketoglutarate causes also a very intense biosynthesis of glutamine. In the wheat plant, the synthesis of glutamic acid from potassium-α-ketoglutarate is accompanied by the increase of γ-aminobutyric acid. The latter is formed with the participation of glutamic acid decarboxylase. The results of these and other experiments, carried out in our laboratory, show that in the live plant glutamine plays two roles. On the one hand, it is the most important compound into which the ammonia entering the plant is fixed. On the other, it is a very important source of amino groups for the process of transamination with keto-acids. When the scheme of biosynthesis and of transformations of glutamic acid and glutamine in the plant is being made up, one must take into consideration the participation of glutamine in the process of transamination. One must also consider the important role of γ-aminobutyric acid as the product of glutamic acid decarboxylation and as the source of amino groups for transaminations.

KREUTZER, WILLIAM A. Shell Development Company, California. *Soil Fungicides.* A soil fungitoxicant acts either as an eradicant or as a protectant. Generally, eradicants are best suited for pre-planting treatments; protectants for treatments at the time of planting or after planting. The type of pathogen and its zone of attack determine that portion of the soil which must be treated. Volatile fungicides usually are non-specific and phytotoxic eradicants, distributing themselves to form distinct diffusion patterns. Non-volatile fungicides in general are relatively non-phytotoxic protectants, and must be distributed in soil by mechanical mixing or by water drenches. Beneficial or detrimental effects of soil fungicides are the results of interactions between the components of soil and the introduced chemicals. The natures of these interactions are determined by both the properties of the soil and the fungicides. The fungicide may be sorbed, solubilized, or chemically degraded by the components of soil. The fungicide produces minor changes in the physico-chemical composition of soil and major changes in the soil biophase. Effects may be most marked in rhizosphere zones as a result of altered microbiological equilibria. Favorable or unfavorable responses depend on effects on plant inhibitors (parasites, toxin formers, and nutrient competitors) and plant sustainers (pathogen antagonists and nutrient formers).

KROTKOV, GLEB. *See* JONES, JOHN D.

KÜCHLER, A. W. University of Kansas. *The Compilation of Small-scale Vegetation Maps.* It is explained why some vegetation maps cannot be based on field work and hence must be compiled. This is primarily true of maps on a small scale. Every step in the process of compiling a small-scale vegetation map is described in detail and fully explained. There are four major steps and several minor ones. The major steps must be taken in the given order, but some of the minor ones are taken simultaneously. The method described in this paper shows the process of compiling a small-scale vegetation map from the very beginning to the completion of the compiled manuscript map.

KUGLER, HANS. Munich, Germany. *Experimental Studies on the Behaviour of Flower-visiting Insects in Relation to the Characters of Flowers.* Since Darwin's time, the relationship between flowers and insects has been of great importance for the theory of evolution. The paper will give a survey of the experimental investigations of these interactions and will thus give the basis for a critical examination of the adaptive value of flower qualities. The vivid flower colours act — according to the colour vision of insects — as attractive stimuli. The attraction is intensified by colour contrasts and designs in the visible and invisible part of the spectrum ("honey-guides"). Surface structures (brightness and velvety lustre) and the brightness of fluid drops also determine the behaviour of insects. With regard to the shapes of the flowers, the two-dimensional starlike forms are preferred to those with undivided contours. Flowers of three dimensions (funnel flowers) have a stronger attraction than those of two dimensions. To insects of chemotactical orientation, odour can be a factor attracting them from a distance. Otherwise, odour is mainly a factor influencing insects immediately before the flowers. This is primarily the function of "odour-guides." The behaviour of flower-visiting insects can be a spontaneous as well as a learning action. The result of the latter is the "flower-constancy" of visitors.

KUIJT, JOB. University of California. *Patterns of Shoot Emergence in Arceuthobium.* Shoots of some *Arceuthobium* species may emerge in predetermined patterns from the host branches. Such regularity is found in *A. americanum*, *A. douglasii*, *A. pusillum*, and *A. minutissimum*, when attacking certain hosts, and is always associated with brooming phenomena of the host. In the first two species the endophytic system is present even in the shoot apex of the host, thus keeping pace with host elongation. For the last two species, the same phenomenon is inferred. The remaining species of *Arceuthobium*, though probably all able to induce brooms, do not appear to show regular shoot-emergence patterns; it is inferred that in these species the endophytic system does not reach the host apex. In *Pilostyles haussknechtii* (Rafflesiaceae) a remarkable parallel is seen: here also a regular pattern of emergence coincides with a penetration of the endophytic system into the shoot apex of the host.

Kuntz, James E. University of Wisconsin. *Oak Wilt: Present Knowledge.* Oak wilt, a serious vascular disease incited by the ascomycetous fungus *Ceratocystis fagacearum* (Bretz) Hunt (conidial stage *Chalara quercina* Henry), occurs in 18 states of the eastern United States. Aerial detection surveys are very effective. All oak species tested and certain related species of the Fagaceae are susceptible although their foliage and internal symptoms vary considerably. The fungus is hermaphroditic, self-sterile, and of two compatibility types. Infection follows inoculation of wounds, especially during springwood development. In nature, certain insects apparently carry and deposit endoconidia and ascospores into tree wounds. Evidence indicates thereafter a rapid distribution of secondary spores, the formation of gums and tyloses within xylem vessels, the development of foliage wilt and necrosis, vascular discoloration, and premature defoliation. Mycelium develops in the xylem vessels and exits intracellularly through the ray parenchyma with formation of sporulating fungus mats between the bark and wood. Infected black oak species usually die the first season; white oak species may persist for years. The fungus is disseminated from tree to tree through grafted roots and over longer distances by vectors. Although no cure is known, disease spread has been reduced or prevented by "severing" roots mechanically and chemically, destroying infected trees, preventing fungus mat formation, avoiding or protecting wounds, and controlling probable vectors.

Kuperman, F. M. Moscow State University. *Regularities in Organogenesis of Higher Angiosperms.* An investigation of the organogenesis of over four hundred species of plants of various families indicated the existence of twelve main stages in organogenesis which are common to all angiospermous plants. The regulation, internal rhythm, and dependence of the duration of the organogenesis stages on environmental factors and also on the development phase and age of the plant have been established. Correlative relations have been established between morphogenetic processes, differentiation of fruit-bearing organs, and growth processes in the stem, leaves, and root system, as well as complexity of the shoot structure along the stem (stage diversity). Among the many factors which affect stage, organotrophic and aging processes during ontogeny, one should take into account the temperature, radiant energy, oxygen pressure, content of water, mineral and organic substances, radioactive background, terrestrial magnetism and electricity, and other life conditions on the Earth. Each development stage as well as each phase of organogenesis is characterized by its own particular set of factors and their intensity. At moderate latitudes the principal factors are: during the first (vernalization) phase, the temperature; during the second (photo-) phase, the length of day and night; the third (spectro-) stage, the quality of light; the fourth stage, the intensity of light; the fifth stage, the nitrogen-phosphorus metabolism. Definite stages of organogenesis correspond to each developmental phase. Stages I-III are passed during the first and second developmental phases, stages IV-V during the third phase, stages VI-VIII during the fourth phase, and stages IX-XII during the fifth. The morphophysiological investigations of organogenesis stages have served as the foundation of the theory of ontophylogenesis of plants developed by the author. The main material has been presented in the paper "Formation stages of fruit bearing organs of gramineous plants," published by the Moscow State University in 1955 and in the journal *Science and Advanced Agriculture* (no. 10, 1958).

Kuprevich, V. F. Academy of Sciences, Minsk. *Physiology of the Diseased Plant.* Investigations of physiological processes of the diseased plant made by the author and other investigators show that infection calls forth a number of changes in the rate of physiological processes at the foci of the disease and in tissues contiguous to them. The changes are pathological in that they all disturb the normal course of processes in a determined degree: increase or decrease their rate; sometimes change the direction of a reaction when the plant's physiological functions could be performed to better advantage, causing it, so to speak, suffering and inconvenience, decreasing the probability that it will produce the optimal number of normal progeny. Pathological changes are usually a result of the action of ferments of a parasite. The presence of toxins in a number of facultative parasites has been established. These toxins cause tissues in the host to atrophy. Pathological changes can also be caused by the action of a virus or factors in the dead medium, including certain forms of competitive relationships when there is insufficient light, moisture, or elements of root nourishment. Any type of disease, even if it appears in a mild form, certainly leads the plant to a loss of productive substance and energy. Usually the break-down process is accelerated, the flow of assimilated products to the growth points is retarded, the growth processes are suppressed, conditions of contact with the outer medium become poorer owing to the partial destruction of the outer covering, resistance to drought and winter conditions decreases, the rate of primary synthesis of simple organic compounds falls, aging processes are accelerated. All this weakens the diseased plant, lowers its productivity and efficiency, and often, where nourishment and moisture for the root are in short supply, causes its untimely death.

Kuprianova, Ludmila A. Academy of Sciences, Leningrad. *Palynological Data Contributing to the History of Liquidambar.* The palynological evidence concerning the origin of Liquidambar is as yet lacking, but there are reasons to suppose that Liquidambar already occurred in the Upper Cretaceous, and that two lines of development of this genus have become distinct in the beginning of the Tertiary. One of these lines was associated with the subtropical flora of Tethys, to which almost all the fossil Liquidambars belong. Another line, which had probably initiated in the Upper Cretaceous, was associated with the temperate flora of Angara. This is proved by the findings of pollen from the Palaeogenic deposits of Kotelnyi Island (Novo-Sibirsk Isles), as well as from the Alaskan Cretaceous and the Paleocene of the Novo-Sibirsk Isles and Greenland. The second line of development is represented by one species only. Later on, the species, including the modern derived from subtropical ones, have developed. At present they belong to the temperate floras which, the climate having become colder, occupy the areas formerly occupied by subtropical floras. The affinity of Liquidambar to the tropical Altingia also indicates the southern origin of the whole group. Consequently, Liquidambar is not a typical representative of the Arcto-Tertiary flora, despite the opinion persisting to the present time.

The findings in the Lower Palaeogen of Kazakhstan of pollen Liquidambar similar to those of the modern Central America (L. *macrophylla* Oerst.) and of China (L. *formosena* Hance) indicate the ancient relationship of the floras of the Mediterranean countries and those of Central America and Eastern Asia.

The history of Liquidambar is elucidated by the palynological materials from the deposits of Eurasia. Probably it might be verified by the findings in the western hemisphere since the developing floras of both hemispheres have been closely associated in the past. The study of the pollen of Liquidambar supplies an additional proof of the possibility of using the pollen for the establishment of fossil species.

KURABAYASHI, M., K. SAMEJIMA, I. FUKUDA, and Y. KOZUKA. Hokkaido Gakugei University and Hokkaido University, Japan. *Interaction between Genetic Drift and Natural Selection as Revealed among Natural Populations of Trillium kamtschaticum.* *Trillium kamtschaticum* is a perennial herb growing under thin deciduous or mixed deciduous woods. Three geographic races have been described in this plant distributed in Japan. Population studies by means of comparative examinations of chromosome composition of natural populations could make clear the mechanism of racial differentiation. It is conditioned, externally, by ecological and climatic factors and geographical changes due to marine invasion and regression during the Pleistocene; and, internally, by evolutionary pressures which operate in populations reflecting changes in the external agencies mentioned above. Here, the mode of interaction between genetic drift and natural selection, both inducing conspicuous evolutionary changes upon natural populations of this plant, is described with reference to the mode of migration and variation in flowering time among the populations. Gradual and continuous exchanges of genetic materials were seen in migration among populations under the predominant influence of selection, while discontinuous migrations occur among those suffering from drift. Flowering time is a character under the direct influence of natural selection. However, the selection does not open a smooth path for adaptation, but proceeds in a zigzag manner, accompanying development of various compensatory systems; the development being, perhaps, assisted by genetic drift.

KURODA, K. *See* KAMIYA, N., *et al.*

KURSANOV, ANDREI L. Académie des Sciences, Moscow. *Tracing Translocation with Isotopes.* (1) Les produits de la photosynthèse formés dans la mésophylle de la feuille lors de l'exposition au cours de 3 minutes avec $C^{14}O_2$ se distinguent des substances radioactives qui s'accumulent durant le même temps dans les tissus conductrices. Cela amène à la conclusion que le déplacement des assimilates vers les voies conductrices ainsi que leur dégagement dans le phloème ne sont pas basés simplement sur la diffusion, mais se trouvent en rapport avec le métabolisme des tissus. (2) La saccharose est la forme principale de transport des hydrates de carbone chez les plantes au caractère de métabolisme très varié. Pourtant, chez certaines espèces de plantes la saccharose cède la place aux oligosaccharides construits sur la base de la saccharose. En particulier, chez *Cucurbita pepo* les principales formes de transport sont la stachyose et la verbascose. Dans le phloème de tout une série de plantes on a revelé α-galactosidase. (3) Les faisceaux lebéro-ligneux de la betterave à sucre se distinguent par la hexokinase active, l'aldolase et la phosphohexoisomérase, ce qui témoigne d'un processus glycolytique fortement développé dans ces tissus.

Kurtz, Edwin B., Jr., and Hollis Waldon. University of Arizona. *A New Role for Sulfur in Higher Plants.* Oat (*Avena sativa*) seedlings were grown on phosphate-deficient medium for three weeks. They were then supplied 5 mc. of $H_2S^{35}O_4$ for five days after which the shoots were harvested, homogenized, and a protein-free extract was prepared. The constituents of the extract were separated by two-dimensional paper chromatography and autoradiography of the chromatograms was used to locate S^{35}. One area of the chromatograms was highly radioactive and also gave a positive test for sugars. This same spot gave a negative test for amino acids, thiols, thiolesters, biotin, inorganic sulfates and bisulfates (tested with barium rhodizonate; glucose sulfate gives a negative test with this reagent), purines, and pyrimidines. Free sugars moved to areas on the chromatograms distant from the area that was radioactive and also contained sugars. Work is now in progress to isolate the compound, which may be a sugar-sulfate.

Kuwahara, Yukinobu, and H. A. Miller. Hattori Botanical Laboratory and Miami University. *Taxonomy and Asiatic Affinities of Metzgeria and Calypogeia from Hawaii. Metzgeria conjugata* ssp. *japonica* is reported for the first time from Hawaii although it has been called *M. conjugata, M. dichotoma, M. pectinata**, and *M. furcata,* by various authors. *Metzgeria papulosa* appears to be a good species based on the lectotype, *Heller 2253,* which is labeled *M. scobina* (a valid Borneo species) in herbaria. *Metzgeria quadriseriata* is the correct name for *M. mauina**. *Calypogeia arguta* has been called *C. bifurca**, *C. pacifica**, and *C. quadrifida** by various authors. *Calypogeia alternifolia* has been called *C. baldwinii* and *C. trichomanis. Calypogeia cuspidata* has been called *C. hawaiica** and *C. confertifolia**. *Calypogeia tosana* has been called *C. bidentula. Calypogeia verruculosa* and *C. aeruginosa* are reported for the first time from Hawaii. *Calypogeia minutistipula* is apparently a *Notoscyphus.* Names marked with an asterisk (*) are new synonyms. Species of *Metzgeria* and *Calypogeia* show the Asiatic affinities of the Hawaiian flora. The floristic relationship between Japan and Hawaii has two expressions. The first, exemplified by *Metzgeria conjugata* ssp. *japonica, M. quadriseriata,* and the widespread *Calypogeia arguta,* suggests a common origin in the East Indies. The second expression is shown by *Calypogeia tosana* and *C. verruculosa* which are known only from Japan and Hawaii.

Laasimer, L. Esti NSV Taeduste Akademia, Zoologia ja Botaniki Institut, Tartu, Estonia. *The Position of Estonia in Phytogeographical and Geobotanical Partitions of North Europe.* On the basis of a geobotanical map (scale 1:42,000) of Estonia, on which the distribution of 45 typological units (groups of associations), 11 sub-units, and 7 reconstructed vegetation units is shown, the author constructed a geobotanical partition of the Estonian SSR. The differences in structure and distribution of the plant communities between West-northwest Estonia on the one hand and East-southeast Estonia on the other are so striking that it is necessary to group them in different higher units of a geobotanical division. The boundary between these two higher units accords well with the line of demarcation separating the two phytogeographical provinces established by Lippmaa 24 years ago. The author designates the two regions parted by this boundary as the East and West subprovinces of the Baltic geobotanical province. Analysing the continuation of the borders of these subprovinces outside Estonian territory, the author comes to the following conclusions. (*a*) Besides West Estonia southern Sweden and a part of southwestern Finland belong to the West Baltic geobotanical subprovince. East Estonia, a part of Russian SFSR, most of Latvian and Lithuanian SSR, and a part of Byelorussian SSR together form the East Baltic subprovince. (*b*) In the character of its flora and vegetation the Baltic province occupies a transitional position between East and Central Europe. Nevertheless, the West Baltic subprovince possesses certain features in common with the phytogeographical province of Central Europe, and the East Baltic subprovince with that of East Europe (Central Russia). (*c*) The Baltic geobotanical province does not belong to Fennoscandia either in a phytogeographical or in a phytosociological sense. (*d*) The further boundaries of the Baltic province outside the Estonian SSR should be determined with the help of large-scale geobotanical maps of North Europe.

LABANAUSKAS, CHARLES K., W. W. JONES, and T. W. EMBLETON. University of California. *Seasonal Changes of Micronutrients in Washington Navel Orange Leaves.* Changes in zinc, copper, manganese, boron, and iron concentrations in Washington navel orange leaves over a twelve-month period were studied. Zinc and copper concentrations in the leaves tended to decrease and manganese, boron, and iron tended to increase with the age of the leaf through the season until midwinter and then before and during initiation of new bloom and flush leveled off with a relatively small decrease and increase, respectively. Boron concentration remained constant during the winter months. Zinc, copper, manganese, and boron concentrations slightly decreased during bloom and initiation of new flush at the end of the growing season. Iron concentration increased with the age of the leaf throughout the growing season with no apparent indication showing outward movement of iron at any time during the season.

LAFOND, ANDRÉ. Université Laval, Québec. *L'Aménagement écologique des forêts de la côte nord de la Province de Québec.* Depuis 1953, plus de 5,000 milles carrés de forêts vierges ou exploitées ont été classifiées sur une base écologique. Une carte à 20 chaines au pouce (approximativement 1:15,000) a été levée à l'aide de la photographie aérienne et complétée par un inventaire forestier. L'étude phytosociologique et pédologique de chacun des différents types de forêt a été faite; quelque 14,000 places échantillons et 11,000 études complètes de tiges ont été recueillies pour établir les tarifs de cubages, le taux de l'accroissement, et le volume-acre de chacun des peuplements en vue d'un aménagement rationnel. Des relations très nettes ont pu être établies entre les associations et les types forestiers, les sols, leur rendement et leur taux d'accroissement. Ces travaux ont montré que ces peuplements ont un rendement potentiel passablement élevé, du moins si l'on considère leur position géographique.

LAFONTAINE, JEAN G. *See* MOSES, MONTROSE J.

LAIBACH, FRIEDRICH. Biologisches Forschungsinstitut, Limburg/Lahn, Germany. *Ueber den Einfluss von Indolylessigsäure, Gibberillinsäure und anderer Chemikalien auf den Blattfall.* Seit unseren ersten Versuchen im Jahre 1933

über den Einfluss von Wuchsstoff (aus Orchideenpollinien) auf die Lebensdauer entspreiteter *Coleus*-Blattstiele haben wir später die Versuche mit Indolylessigsäure (IES) häufig wiederholt und bestätigen können, dass besonders bei mehrfacher Behandlung der Schnittfläche mit IES sehr starke epinastische Krümmungen am Stiel verbunden mit einer langen Hinauszögerung des Stielfalls verursacht wurden. Ich stehe daher auch heute noch wie damals auf dem Standpunkt, dass das durch den Wuchsstoff im Stiel in Gang gehaltene oder neu angeregte Wachstum die primäre Ursache für die verzögerte Abszission ist. Es steht das im Gegensatz zu der Auffassung, dass distale Zufuhr von Wuchsstoff zur Trennschicht auf direktem Wege eine frühere Abstossung des *Coleus*-Stieles bewirkt. Proximale Zufuhr zur Trennschicht soll dagegen einen beschleunigten Stielfall hervorrufen. Ich führe auch dies auf Wachstumsprozesse zurück. Versuche des Winters 1957/58 und 1958/59 haben gezeigt, dass die sehr früh abfallenden Bracteen der Infloreszenzen mancher *Coleus*-Arten (*C. frederici, C. shirensis u.a.*) um so später abgestossen werden, je weniger Blütenknospen in ihren Achseln vorhanden sind. Man kann den Fall dieser ephemeren Gebilde sogar so stark verzögern, dass sie in der Lebensdauer mit gewöhnlichen Laubblättern übereinstimmen, wenn man die Achselknospen frühzeitig exstirpiert. Das beruht nicht darauf, dass die Achselknospen den Bracteen proximal Wuchsstoff zuführen, der beschleunigend wirkt, sondern, dass die in den Bracteenachseln entwickelten Blütenknospen einen erheblichen Stoffverbrauch haben und diese den Bracteen entnehmen. Durch Exstirpation der Achselknospen im frühen Zustand fällt das weg. Man kann diese Auffassung beweisen. Gibberillinsäure (GS) verursacht an entspreiteten C.-Blättern keine Verzögerung des Stielfalls, aber auch an der behandelten Schnittfläche keine Kallusbildung sowie im Blattstiel kein Längenwachstum. Mittels GS kann man aber ein erheblich gesteigertes Streckungswachstum im Stengel erzielen. Wenn man an den Sprossen mit GS-gesteigertem Streckungswachstum die Blätter entspreitet, dann fallen die Stiele wesentlich früher ab als an nicht mit GS behandelten Sprossen. Es ist aber nicht proximal wirkender Wuchsstoff (IES), sondern die Wachstumsförderung unterhalb der Trennschicht. Für *Coleus* gilt also, dass Wachstumsförderung in dem zum Abfallen bestimmten Organ eine Verzögerung, unterhalb des Organs aber eine Beschleunigung der Abszission hervorruft. Neben dieser indirekten Beeinflussung der Trennschicht durch Wuchsstoff an C.-Pflanzen, gibt es auch eine direkte, wie die schnelle Reaktion mancher Organe auf Chemikalien (z.B. gewisse Gase) zeigt. Auf das Verhalten von Explantaten und von Blumenblättern (*Origanum, Papaver, Cistus*) soll im Vortrag eingegangen werden.

LAMB, I. MACKENZIE. Harvard University. *Progress Report on the Index of Lichen Names Published between 1932 and 1958.* The preparation of this index of all new taxa and combinations in lichens published between 1932 and 1958 with the support of the National Science Foundation is now entering its final stage and will probably be published in late 1960. It contains also the lichen names applied to non-lichenized fungi which were omitted in Zahlbruckner's *Catalogus lichenum universalis.* A specimen sample page will be distributed at the meeting for criticism and discussion.

LANCE, ARLETTE. Laboratoire de Botanique, Paris. *Interprétation du fonctionnement de quelques méristèmes apicaux d'après l'étude cytologique.* Pendant la phase végétative, les cellules latérales de l'apex montrent des caractères très

méristématiques. La zone apicale axiale est moins dédifférenciée. Le premier de ces territoires est organogène, son rôle est inducteur, actif et déterminant; il édifie les feuilles: c'est l'anneau initial de Plantefol. Le deuxième constitue le méristème d'attente de Buvat; sa faible activité, durant la phase végétative, présente un caractère induit, c'est à dire passif. Au dessous de lui, le méristème médullaire édifie la moelle. L'étude cinétique de l'apex permet de décrire les processus qui se répètent périodiquement, au cours de chaque initiation foliaire, et qui caractérisent le fonctionnement plastochronique de l'anneau initial; elle permet de saisir la présence de zones apicales transitoires d'harmonisation de croissance qui coordonnent le fonctionnement du méristème dans son ensemble. Cette méthode d'étude précise, enfin, le rôle de chacun des territoires apicaux dans l'édification de la tige. Le passage à la phase reproductrice est marqué par d'importants changements de forme et de taille du méristème et par une dédifférenciation profonde des cellules du méristème d'attente végétatif qui entre vraiment alors en activité. Les divers processus qui accompagnent l'édification du méristème reproducteur sont décrits.

LANG, ANTON. University of California. *The Place of Gibberellin and Auxin in Flower Induction.* Gibberellin (GA) induces flower formation under strictly non-inductive conditions in numerous cold-requiring and long-day plants. Flower induction in these plants appears to be accompanied by quantitative and qualitative changes in their content of native gibberellin-like regulators. Thus, gibberellins seem to be involved in the flower-inducing "mechanism" of plants and seem to be the limiting factor in this mechanism in certain plants. The flower-inducing action of GA appears to be limited to rosette plants, and moreover to such rosette plants in which the primary axis is capable of elongation. GA treatment does not seem to induce flower formation in caulescent plants, or in rosette plants in which flowers or inflorescences are formed from axillary buds while the terminal bud of the shoot persists in the rosette habit of growth. Thus, gibberellin seems to act primarily by removing a specific kind of limitation to shoot elongation and not to be effective on flower formation in plants in which shoot elongation is not limited at all, or is limited in some other, basically different manner. In those plants in which GA may induce flower formation there are considerable differences between species: some respond readily and completely; others slowly and/or less regularly; some may not respond at all. However, these differences in responsiveness seem to be quantitative and not qualitative in nature and there seem to be all kinds of transitions between the extreme types. Therefore, these differences seem to reflect quantitative differences in the flowering mechanism of these plants (e.g., in the balance of promotive and inhibitory factors or processes, GA being one of the former) rather than qualitative differences.

LARIN, I. V. Leningrad. *The Vegetation of Natural Grasslands of the U.S.S.R.* The area of natural grasslands in the U.S.S.R. comprises 565 million ha., including 207 million ha. of tundra and forest tundra, and 358 million ha. covering other zones; 59 million ha. are used as meadows, and the rest as ranges and pastures. More than 12,000 species of higher plants grow on the natural grasslands, including about 1,000 species which form the bulk of vegetation and are dominants. The most significant among them are: Gramineae (215 dominants), Compositae (127), Cyperaceae (112) and Chenopodiaceae (83).

Leguminosae, Umbelliferae, Rosaceae, Cruciferae, Labiatae are also found in appreciable quantities. Of 5,000 studied species: 29 per cent are very palatable, 27 per cent fairly, 16 per cent poorly and 28 per cent almost unpalatable; more than one-third among the last of these being poisonous and harmful plants. The majority of very palatable and fairly palatable species belong to the Leguminosae, Gramineae, Compositae, Chenopodiaceae, Cyperaceae, Rosaceae, Umbelliferae, and Caryophyllaceae. Urticaceae, Cruciferae, Leguminosae, Polygonaceae, Chenopodiaceae, and Ranunculaceae are marked for their high content of protein (more than 14 per cent in dry matter when harvested at the flowering stage) and low content of fiber (less than 26 per cent). The chemical composition of the Gramineae is less favourable. In all, 224 million tons of forage (in dry weight) consumed by cattle are annually obtained from the natural grasslands of the U.S.S.R. The yields of forage consumed by cattle vary from 0.3-0.5 centners per ha. (tundra, saline lands of desert) to 45 centners (some flood and mountain meadows), depending on the zone and the type of grassland.

LARSEN, C. SYRACH. Arboretum, Horsholm, Denmark. *Relation between Forest Botany and Tree Breeding.* The extensive employment of vegetative propagation in forest tree breeding must offer, in the widest sense, the possibility of widening botanical observations to all botanists – taxonomists, plant physiologists, plant pathologists, etc. At the same time, foresters request help from the botanists to ensure that the work will be carried out on a scientifically correct basis. To illustrate these facts, examples will be used of species hybridization, clones within the single species, and different physiological values of a single individual at different ages.

LARSEN, POUL. University of Bergen, Norway. *The Physical Phase of Gravitational Stimulation.* In order to understand how physiological processes can be initiated by a change in the position of a plant organ in relation to the direction of gravitation, it is necessary to assume the existence of statoliths in the plant. Various cell constituents (starch grains, macromolecules, dipols, ions) have been assumed to function as statoliths, but direct proof for such function of any of these particles is lacking. By measuring the geotropic reactions in roots following various manipulations of the plants, the writer thought it might be possible to disclose some general properties of the postulated statoliths even without identifying them with known cell constituents. From data by W. Zimmermann (1927), it was deduced that maximum stimulation should be reached by exposure at an angle more than 90° removed from the neutral direction. By means of a special technique, the writer succeeded in showing that the optimum angle is larger than 90° even after exposures as short as one minute. The optimum angle, however, decreases regularly from 132.5° at 7.5 min. to nearly 90° at 0.47 min. of exposure. This behavior can be interpreted as a result of damped oscillations modified by a constant, longitudinal force. Regarding the statoliths as electrically charged pendulums leads to formulations that fit observations better than Metzner's "extended sine rule" which assumes a variable longitudinal force.

LATIES, GEORGE G. University of California. *The Organization of Energetic Systems.* With the recognition of the heterogeneity of the plant protoplast at the sub-microscopic level has come a revised concept of the factors involved in the coordination of metabolic activity within the cell. The manner in which the metabolism of cellular substrates leads to the release and utilization of chemical energy is determined not only by the nature and prevalence of the enzymes involved, but also by the physical relation which both individual enzymes and enzyme systems bear to each other. The cytoplast is comprised of discrete microstructures which are the seat of metabolic systems involved in the energy metabolism of the cell. The metabolic role played by these microstructures — the mitochondria, microsomes, and possibly the lysosomes and endoplasmic reticulum — depends upon the integrity of the fine structure of these elements, as well as upon their relation to each other. In addition, the activity of cellular particulates is strongly influenced by the metabolic events in the surrounding cytoplasm, and the over-all energy metabolism reflects the interaction of cytoplasmic and particulate components. In this connection the nature of the barriers between cellular components and the control exerted by these barriers over the exchange of metabolites are of the utmost importance. Ontogenetic changes in the nature and in the fine structure of cell particulates are reflected in the metabolic behavior of cells and tissues. Whether the distribution and organization of sub-cellular components are factors in differentiation remains a moot point.

LAWSON, G. W. University College of Ghana. *Application of Analysis of Variance to Problems of Intertidal Ecology.* A method whereby analysis of variance can be applied to the solution of problems of shore ecology is outlined. Its aim is to separate the effects and interactions of natural factors on growth of intertidal plants. To illustrate the method, variation in the dry weight and number of plants per 20 cm.^{2} quadrat in relation to wave exposure, shading, and angle of rock surface is worked out for *Sargassum* as it occurs on the coast of Ghana. Under the condition existing in the quadrats analysed, *Sargassum* seemed to be most influenced by shading which acted on growth (i.e., dry weight) in an adverse manner, but there was also an interaction effect between rock angle and wave exposure. Number of plants per given area also seemed to be influenced most by shade, again in an adverse fashion. Average weights of individual *Sargassum* plants subject to the factors mentioned above did not vary significantly except for an interaction effect between wave exposure and shade causing unshaded plants in sheltered places to be especially heavy.

LEBEAU, J. B., and M. W. CORMACK. Canada Agriculture Regional Research Station, Alberta. *Snow Mold of Legumes and Grasses in Western Canada.* The distribution of snow mold pathogens in Western Canada is similar to that in Scandinavia: *Sclerotinia borealis* Bub. & Vleug. is found in the extreme northern areas and *Typhula* spp. and *Fusarium nivale* (Fr.) Ces. occur farther south. These pathogens are of minor or local importance. An unidentified low-temperature basidiomycete, not yet reported from other countries, is widespread in Western Canada and is responsible for great losses in forage legumes and grasses. This basidiomycete synthesizes hydrogen cyanide in culture and in plant tissues and the concentrations of this lethal gas recovered from diseased tissues have been shown to be proportional to the damage in the affected plants. Studies on other snow mold pathogens failed to reveal the same mechanism of parasitism. Analyses made at two-week intervals from September to May, on alfalfa plants infected with the low-temperature basidiomycete, showed the highest concentrations of hydrogen cyanide in the crown buds in January, February, and March. The disease developed from field inoculations made in September and October, but no damage occurred when the plants were inoculated after November 15. A few legumes and grasses have shown resistance to this basidiomycete, but the nature of resistance is unknown.

LEBLANC, FABIUS. Université de Montréal. *Ecology of the Corticolous Epiphytes of the St. Lawrence Valley, Canada.* Twenty 200 m.^{2} quadrats were traced in different forest associations (Dansereau, 1959) of the St. Lawrence Valley. Trees were arbitrarily divided into three sizes according to their circumference: 3-10 in.; 11-30 in.; 31 in. and over. The trees of each quadrat were tabulated as to species and a search was made to determine the presence or absence of epiphytes on the base and bole of each tree. Although the St. Lawrence Valley appears to be rather poor in epiphytes when compared to other regions of Quebec, it has, nevertheless, a surprisingly high percentage of these plants. A total of 945 trees was examined, and 724 (77 per cent) had epiphytes either on the base and/or on the bole. In each quadrat about six trees were minutely studied at four levels: at the base, at 6 ft., at 20 ft., and at 35 ft. A 1 ft. high band encircling the tree at each level was divided according to exposure (north, south, east, west) into four equal quadrats. A tabulation was made of the epiphytes in each quadrat. Epiphyte communities have been correlated with the phorophyte, the vertical zonation, and the direction of exposure. Correlations were also made with the roughness of the bark, its pH, and water-holding capacity.

LEBRUN, J. Laboratoire d'écologie végétale, Bruxelles. *Sur quelques concepts écologiques applicables en chorologie.* L'analyse des éléments et groupes phytogéographiques d'un territoire donné permet de déduire diverses notions à portée écologique, susceptibles d'un grand intérêt en chorologie. Quelques-uns de ces concepts sont définis comme suit. (1) L'état naturel de la flore d'un territoire exprime son degré de "souillure" par des types plus ou moins ubiquistes, dont la présence traduit généralement une action anthropique plus ou moins profonde. L'importance relative des espèces à large distribution exprime le mieux cet état naturel, car c'est à ce groupe phytogéographique qu'appartient la majorité des nitrophytes anthropo-zoophiles. (2) L'homogénéité (ou la pureté) de la flore découle de la considération des espèces de liaison ou plurirégionales à aire relativement restreinte; leur taux élevé indique une contestation écologique des territoires en cause. (3) L'individualité d'une flore se rapporte à la richesse relative de l'élément-base ou du sous-élément-base. (4) L'originalité d'une flore d'une territoire, enfin, découle du taux d'espèces endémiques ou à distribution limitée, caractérisant diverses circonstances de confinement écologique. L'usage de ces divers concepts permet généralement d'asseoir un diagnostic écologique précis de l'ensemble floristique d'un territoire.

LECHEVALIER, H. *See* KATZ, E.

LECHEVALIER, HUBERT, and ANNA C. TIHONIENKO. Rutgers, The State University, New Jersey, and Academy of Sciences of the U.S.S.R. *Effect of Nutritional Conditions on the Spore Surface of Actinomycetes.* Four strains of aerobic actinomycetes, from Krassilnikov's collection, were selected for their ability to form chains of spiny spores on both synthetic and complex organic media. These strains were grown on 24 synthetic media and six complex organic media. Whenever abundant sporulation was obtained, observations of the spores were made under an electron microscope. Variation in the appearance of the spores, affecting the clarity with which spines could be demonstrated, was noted from one medium to the other. Since the morphology of the spore surface has been suggested as a criterion in the classification of these organisms, the authors conclude that systematic descriptions of actinomycetes would be most valuable if the media used to grow the materials for sub-microscopic observations were always specified and if synthetic media were always used.

LECLERCQ, SUZANNE. Liège University, Belgium. *Strobilar Complexity in Devonian Sphenopsids.* Scanty evidence of sphenopsids is known in Precarboniferous times. Recently, four new types of fructifications have been found in Devonian strata. In Belgium, a cone named *Eviostachya hoegi* Stockmans was discovered in Upper Devonian. Its chief point of interest consisted of an elaborate sporangiophore divided in nine segments supporting altogether 27 anatropous sporangia disposed in two circles. In Middle Devonian, two new species of Protoarticulatae have been studied whose main features are: *Calamophyton bicephalum* Leclercq & Andrews, sporangiophores branched in an upper and a lower segment giving off three side stalks, each bearing two anatropous sporangia, a total of twelve; *Hyenia complexa* Leclercq, the emission of pairs of sporangiophores, giving off three lateral stalks prolonged by spiniform appendages and bearing two anatropous sporangia, a total of twelve. From the Lower Devonian of West Siberia, a probable forerunner plant, *Protohyenia janovii* Ananiev has been described, consisting of aerial sterile and fertile shoots found in association. The most remarkable character was in the terminal position of pairs of erect sporangia located at the tip of each segment of the divided lateral appendage which in form and size was like the sterile leaf. These discoveries throw some light on the sphenopsids' past history.

LECLERCQ, SUZANNE, and HENRY N. ANDREWS, JR. Université de Liège and Washington University, St. Louis. *Calamophyton from the Middle Devonian of Belgium.* The *Calamophyton* specimens on which this study is based were collected by Leclercq in 1949 and 1952 from a lower Givetian horizon at Goé, a small village about 30 km. east of Liège. Although many specimens are represented in the collection, the present account is based on five which clearly display the characteristic habit of the genus. Our investigation has dealt chiefly with an elucidation of the structure of the ultimate sterile and fertile appendages. The sterile appendages (leaves) are shown to be three-dimensional structures that forked two to four times and were probably rather rigid and terete in cross-section. The fertile appendages (sporangiophores) divided into two segments or "heads," an upper and a lower one, each of which bore three short side stalks that terminated in a pair of anatropous suspended sporangia. Altogether a sporangiophore had two heads supporting twelve sporangia when none of them aborted. In view of this characteristic structure and the fact that it is appreciably more complex than the corresponding organ in other Calamophytons, we have given the Belgian specimens the new name *Calamophyton bicephalum.*

LECLERCQ, SUZANNE C. M., and HARLAN P. BANKS. University of Liège, Belgium, and Cornell University, Ithaca, New York. *Pseudosporochnus Is Not a Psilophyte.* The study of 534 specimens of *Pseudosporochnus* collected in a single outcrop by Leclercq in 1949 and 1952 has given the authors the opportunity to work out: (1) the plant's habit which was that of a small tree; (2) the mode of branching which consisted of a main stem, two orders of branches, and spirally arranged ultimate appendages (leaves); (3) the ultimate appendages (leaves) whose rachis gives off several successive pairs of opposite divisions; each of the numerous divisions then divides by several successive dichotomies; the whole appendage is arranged in three dimensions; (4) the organization of the fertile fronds, on which pairs of erect, terminal, well-developed sporangia were borne on the tips of some or all of the fine divisions of the ultimate appendages (leaves); (5) the highly differentiated vascular system of the first and secondary order branches, which consisted of a very complex stellate form with long slender arms. The conclusion to which the various characters point, and especially the anatomy, is that *Pseudosporochnus* had more in common with the Cladoxylaleae than with any other group of plants at present known, and that it must be removed from the Psilophytales.

LEDINGHAM, GEORGE F. Regina College, University of Saskatchewan. *Chromosome Numbers of Astragalus and Oxytropis (Leguminosae).* A study made of the chromosome numbers of certain species of *Astragalus* and *Oxytropis* in relation to their geographical distribution throws some light on the origin and evolution of these genera in North America. Eurasian species of *Astragalus* and *Oxytropis* have chromosome counts based on an 8 series ($2n = 16, 32, 48, 64, 96$). Some of these Old World species have migrated, with little further evolution, into North America. They have apparently come in through the northwest during fairly recent times and very few of them have spread south of Canada. Typical North American species of *Astragalus* occur largely in the southwest United States with a few species in the southern part of Western Canada. This group has a basic chromosome number of 11 or 12 ($2n = 22, 24$, and one polyploid with 44) instead of the basic number of 8. Thus, its chromosome number and distribution are distinctly different from that of the Old World group. It seems obvious that this group should be removed from the *Astragalus-Oxytropis* complex and raised to full genus status.

LEE, MIN JAI, EUL SUK CHOE and SANG SHIN PARK. Seoul National University. *A Study of Some Physiological Characteristics of Euglena.* The comparative studies of the quantitative measurement of growth characteristics and utilization of substrates by the cells of *Euglena gracilis* var. *bacilaris* Pringsheim have been carried out in light and in darkness. The effect of respiratory inhibitors and 2,4-dichlorophenoxyacetic acid (2,4-D) on endogenous respiration and responses to the added substrates for exogenous respiration and amino acids are also investigated. Sixteen kinds of media are used in this experiment: a basal medium (Cramer, 1952) as the control, one deprived of Vitamin B_1, another of Vitamin B_{12}, 0.5 per cent ascorbate, sucrose, glucose, Na-citrate, succinate, malate, butyrate, Na-oxalate, Na-acetate, maltose, hydroquinone, lactate, and 2 per cent ethanol, added to each separate basal medium, respectively. Both in light and dark the degree of growth-rate increase of the organism is found in the following order: the basal media added 0.5 per cent lactate and 2 per cent ethanol, 0.5 per cent succinate, 0.5 per cent Na-acetate, and 0.5 per cent malate. Similar results are also found in the exogenous respiration. The endogenous respiration of the cells is strongly inhibited by 0.1 M of KCN, malonic acid, NaF, and iodoacetic acid. Twelve kinds of free amino acids are detected in this organism.

No differences in the kinds of amino acids in the organism are found whether grown in light or in darkness. The effects of 2,4-D are also remarkable in this organism: the growth is strongly inhibited by 0.1 per cent 2,4-D in light and in dark cultures. Endogenous respiration is also inhibited by the same concentration of 2,4-D.

LEE, SHUN CHING. National Taiwan University. *The Taiwan Red and Yellow Cypress and Their Conservation.* The Taiwan red and yellow cypress are the most important coniferous trees of Taiwan and produce excellent construction timbers, of particular usefulness in sub-tropical countries against termites. Unfortunately, these valuable trees, for some reason or other, are now nearing extinction. Hence, the following problems call for a critical study: (1) Why are Taiwan cypress endemic to Taiwan? (2) Why are they now nearing extinction? (3) How are a proper forest management and adequate silvicultural methods to be maintained to preserve these valuable species? The summary and conclusion of the ecological and silvicultural studies of the above problems are as follows. (1) Peculiar climatic conditions occurred in this particular region, combining high relative humidity, cool temperature, moderate high annual precipitation, and the influence of prevailing typhoons. (2) Taiwan red and yellow cypress are light-demanding species. The thick and luxurious undergrowths of the forest floor, impeding the fallen seeds in germination and growth, the cutting away of Taiwan cypress in all accessible regions, and the leaving of too many overmatured trees bearing no more seeds for natural regeneration in all inaccessible places are causes of this tendency to extinction. (3) The overmatured stands of forest should be cut off in a period of 100 years, instead of 40 as under the present management plan, and the age classes of the normal forest should be regulated so that the rate of growth and yield will be balanced and matched up with the 120-year rotation. (4) Artificial reforestation with seedlings raised from seeds of selected mother-seed trees is the only way to preserve these valuable species from extinction.

LEEPER, ROBERT W. *See* GOWING, DONALD P.

LEMÉE, GEORGES. Faculté de Sciences, Strasbourg. *Sur la teneur en chlorophylle et ses variations dans les feuilles des espèces ligneuses de la zone de forêt hygrophile en Côte-d'Ivoire.* La teneur en chlorophylle des arbres et arbustes de la zone de forêt pluvieuse ivoirienne ne montre aucune relation avec leur comportement héliophile ou sciophile, qu'elle soit établie par rapport au poids sec ou à la surface. Mais son évolution, par unité de surface, est différente: chez les héliophiles (parasolier par ex.), l'élévation du taux chlorophyllien se poursuit plus longtemps et jusqu'à une valeur plus élevée dans les feuilles ensoleillées; l'inverse a lieu chez les sciophiles (*Cola gabonensis* par ex.). Lorsque l'éclairement est augmenté pendant la phase d'enrichissement en chlorophylle, il en résulte une plus grande hausse de la teneur en pigment pour les héliophiles, une dépression pour les sciophiles. Lorsqu'il est diminué, le phénomène inverse se produit. Ainsi la distinction entre espèces à chlorophylle photostable et photolabile, établie pour des espèces européennes, s'applique aux espèces ligneuses équatoriales, où elle est en rapport avec leur comportement vis-à-vis de l'éclairement. Le rapport des chlorophylles a/b montre généralement des valeurs plus élevées en exposition découverte, mais le passage de l'ombre à la lumière abaisse ce rapport, soit par destruction plus rapide de a (sciophiles), soit par production plus rapide de b (héliophiles).

LEMS, KORNELIUS. Goucher College, Baltimore. *Ecological Analysis of the Flora of the Canary Islands.* The flora of the Canary Islands, consisting of about 1,400 species of vascular plants, was analyzed for life forms, growth forms, dispersal types, association in plant communities, and geographic origin of the species. Materials were collected under the auspices of the University of Michigan Botanical Gardens. Certain significant correlations were established. It appears that present-day plant communities are aggregates of species from one or two floristic groups. Endemic species predominate in shrubby formations; Macaronesian species predominate in the forest belt; annuals and perennial herbs of disturbed habitats are largely Mediterranean imports. Dispersal analysis showed that many endemic species have nondescript disseminules; Macaronesian trees are berry-producers; Macaronesian ferns are wind-dispersed. Weeds and other non-endemic plants have a variety of well-adapted disseminules. From their geographic affinity it may be deduced that the floristic fragments of which the Canarian flora consists have arrived at different times in the past. Correlations mentioned in this paper are best explained by the assumption that many endemics are primitive forms surviving in the Canaries only.

LENTZ, PAUL L. U.S. Department of Agriculture. *Forest Decay Fungi of Mississippi.* This is a cooperative research project, with participation by a mycologist and forest pathologists of the U.S. Department of Agriculture. Primary emphasis is directed toward obtaining named cultures of wood-inhabiting fungi to facilitate future identifications of cultures obtained from either basidiocarps or decayed wood. Five hundred and sixty basidiocarp specimens were collected from the hardwood forests in the vicinity of Stoneville, Mississippi, emphasis being placed on collection of the relatively obscure corticioid and hydnoid fungi rather than on the more conspicuous and more thoroughly studied polyporoid fungi. Cultures were obtained by mass spore isolations from 235 collections. As the basidiocarps have been named, the cultures are identified with the corresponding named basidiocarps and are then retained as standard reference cultures in the forest diseases laboratory at Beltsville. Photographs and drawings are utilized for visual characterization of a considerable number of basidiocarps and cultures. In addition, habit photographs of forest areas and decayed timber and a display of utensils and equipment used for isolation and identification work help to demonstrate the scope of this project.

LEONARD, JEAN J.-G. Institut National pour l'Etude Agronomique du Congo Belge (I.N.E.A.C.), Bruxelles. *Attitude du systématicien à l'égard de l'emploi de caractères autres que ceux basés sur la morphologie traditionnelle.* Jadis: base de la systématique des phanérogames: morphologie externe de la fleur; le systématicien morphologiste descripteur. Actuellement: appel aux données de disciplines connexes; systématique moderne science de synthèse; systématicien actuel homme orchestre. Attitude du systématicien moderne à l'egard de données nouvelles: les utiliser pour établir corrélations avec caractères traditionnels et pour proposer système naturel. Ces données caractèrisent-elles un groupe (ex.:

genre) à l'exclusion de groupes voisins? Souvent oui: anatomie, xylologie, palynologie, blastogénie (plantules); moins souvent: nombre chromosomique. Conditions d'utilisation des données nouvelles — nécessité préalable: examen des données nouvelles sur nombreux genres même famille; définir valeur systématique des données nouvelles. Attitude du systématicien en cas désaccord: détermination correcte matériel de base des données nouvelles? Nécessité absolue possibilité contrôle détermination par citation herbiers, sinon données sujettes à caution; désaccord — indice de mauvaise classification? Si désaccord persistant: contradictions internes, problèmes systématiques délicats; certains caractères en avance dans voie évolution. Comment résoudre contradictions internes: définir valeur systématique de chaque caractère; établir hiérarchie des valeurs des caractères; faire synthèses des caractères différentiels et communs; conclure. Remarques: (1) diviser plutôt qu'unir; (2) en cas équilibre: préeminence morphologie florale; (3) systématicien seul juge. Conclusions: (1) afin faciliter établissement système naturel classification, nécessité contacts plus étroits entre systématiciens et chercheurs disciplines connexes; (2) avenir de la systématique réside dans travail d'équipe plein de promesses.

LEPAGE, M. *See* BENSON, A. A., *et al.*

LERMAN, R. I. *See* KONOVALOV, I. N., *et al.*

LEROY, J. F. Muséum National d'Histoire Naturelle, Paris. *Problèmes relatifs à la taxonomie et à l'évolution chez les Méliaceae.* L'étude (encore partielle) des Meliacées de Madagascar apporte des changements considérables d'ordres géographique, morphologique, et taxonomique, à notre connaissance de la famille, telle qu'exprimée dans la monographie de Harms (1940). Géographie: paléoendémisme, profondément marqué (50 pour cent des genres sont endémiques); affinités avec l'Amérique et l'Asie relativement faibles, fortes avec l'Afrique; absence des Cedreloideae à Madagascar. Taxonomie: découverte de cinq genres nouveaux et de plusieurs dizaines d'espèces nouvelles; retrait des Méliacées des genres *Ptaeroxylon* et *Cedrelopsis* transférés, dans l'ordre des Sapindales comme membres constituants de la famille des Ptaeroxylaceae. Morphologie: mise en évidence de plusieurs belles séries évolutives *Khaya-Neobeguea, Carapae-Capuronianthеae, Cedrelopsis-Ptaeroxylon.*

LEVITT, J. University of Missouri. *Contribution to Symposium on Apparent Free Space (A.F.S.).* The concept of free space gives rise to two questions: (1) what is its significance in ion absorption? (2) where is it located in the tissue? (1) Free space points to the true significance of diffusion in ion absorption as falling somewhere between the old ideas and the new. Its most important contribution is the logical explanation it gives for the effect of transpiration on ion absorption. (2) It was earlier concluded that the probable location of the free space is in the cell wall (Levitt, Physiol. Plant. *10:* 882-888, 1957). Early determinations of A.F.S. were apparently too high to be accounted for by the cell wall. Calculations showed that if a surface film were allowed for, the values all reduced to about 8 per cent, which could be accounted for by the cell wall. Some of the more recent results agree with this conclusion, others do not. A possible complicating factor that might lead to variations in values for A.F.S. for

any one tissue is supplied by the carrier system. If this has a rapidly regenerated surface, it might, under conditions of active absorption, give rise to higher A.F.S. values, though not appreciably changing the actual static value for free space.

LEVITT, J. *See* SULLIVAN, CHARLES

LEVRING, TORE. University of Göteborg, Sweden. *Submarine Illumination and Vertical Distribution of Algal Vegetation.* The significance of submarine illumination to the marine vegetation is a question which involves many complex problems. The light intensity is reduced due to absorption and scattering by water and dissolved substances or suspended particles. This extinction is different for different wave-lengths. Red light is absorbed almost completely in a water layer of 5 m. The transmission of blue light depends considerably on the water content of suspended particles and dissolved substances. In coastal waters (northwestern Europe) there is therefore a transmission maximum in the green. The illumination below 10 m. is thus greenish. In very clear oceanic waters this maximum lies in the blue. With increasing depth the illumination is reduced more or less logarithmically. As light energy is necessary for the photosynthesis of the algae, their vertical distribution depends not only on the intensity but also on the spectral composition of the light in different depths. A green alga is hardly able to make use of any green light, whereas a red alga and to some extent a brown one is. There are different types of algae adjusted to different light intensities. The occurrence of different sensitizers (beside chlorophylls, phycoerythrin, phycocyan, and fucoxanthin), which make it possible for the algae to utilize light of different spectral composition, also plays an important role in the constitution of these types, that is, the algae are adjusted not only to different light intensities, but also to different spectral compositions of the light.

LEVY, J. F. Laboratoire Cooperatif de Diagnostic Foliaire, Montpellier, France. *Recherches en cours sur la fumure de la vigne en relation avec le contrôle de son alimentation par diagnostic foliaire.* Un vaste programme d'essais a été entrepris par l'Institut Technique du Vin depuis 1956 en vue d'étudier l'action individuelle et combinée des engrais azotés, phosphatés et potassiques sur la vigne dans les conditions correspondant à des exploitations typiques des différentes régions viticoles de France. Tous les essais entrant dans le cadre de ce programme sont mis en place et suivis conformément à un même protocole, qui comporte des conditions particulièrement rigeureuses de contrôle cultural et biochimique. Dans un essai situé en terrain naturellement riche, on a expérimenté depuis deux ans l'action de doses considérables allant jusqu'à 1.200 Kg./ha. de N et de K_2O, et 2.000 Kg./ha. de P_2O_5. Il n'est pas possible pour l'instant de déceler une action significative favorable ou défavorable, de ces apports massifs sur les variables culturales bien que l'analyse du sol ait prouvé que les engrais soient descendus au niveau des racines. L'analyse foliaire ne montre non plus pour le moment aucun enrichissement des échantillons prélevés sur les parcelles ayant reçu N et P. Seul l'apport de K accroît significativement la teneur des feuilles en K, et diminue la teneur en N. Ces résultats s'ils sont confirmés au cours des prochaines années, sont de nature à modifier certaines conceptions couramment admises en matière de fumure de la vigne.

LEVY, J. F. *See* RICHARD, L.

LEWIN, JOYCE C. Woods Hole Oceanographic Institution, Massachusetts. *Cellular Dimorphism in Phaeodactylum tricornutum Bohlin.* Cells of the marine, littoral diatom *Phaeodactylum tricornutum* are of two main types: oval cells, which usually possess one silica valve, and fusiform cells, which have no silica valve. Although each of these types can reproduce by binary fission, interconversions are not infrequent. Certain cultural conditions favor one or the other form. For example, in liquid seawater media, fusiform cells remain predominant, whereas when cultured for some weeks on the surface of agar they tend to give rise to oval cells. In liquid media containing 2.0 per cent NaCl (0.3 M) fusiform cells multiply without appreciable transformation, and in a culture inoculated with oval cells, fusiform cells soon predominate. In media of lower salinity containing 0.25 per cent NaCl (0.04 M), the growth of fusiform cells is completely inhibited by 0.002 M KCl whereas oval cells continue to reproduce actively in media containing 0.015 M KCl. By means of this differential sensitivity to K at low salinity, it is possible to maintain oval cells in liquid media without appreciable growth of fusiform cells. For a critical study of factors which may induce interconversion between the cell types, the effects of environmental factors on their respective rates of multiplication must also be considered.

LEWIN, RALPH A. Woods Hole, Massachusetts. *Eksperimentaj studoj pri la flageloj de algoj.* Elektron-mikrografajoj jam montris ke la flageloj de algoj, kiel la cilioj kaj spermatozoaj vostoj de la plejmultaj estajoj, estas strukture tre similaj. Car supozeble ankau la movoregantaj biokemiaj sistemoj estas similaj — ce diversaj organismoj, la konoj akiritaj per studo de unu specio povus esti generale aplikeblaj. La flageloj de *Chlamydomonas* defalas kian oni submetas la celojn al malfavoraj temperaturoj, pH k.t.p., tiel faciligante la kolekton de kelkaj miligramoj por kemia analizo. Lau la proporcioj de siaj amino-acidoj, la flagela proteino similas nek al tiu de bakteriaj flageloj nek al tiuj de muskoloj. Vivantaj celoj povas kreskigi novajn flagelojn en dauro de 30-60 minutoj post resubmetigo al favoraj kondicoj. Post ultra-viola radiado estas izolitaj senmovaj mutaciuloj de *Chlamydomonas* (4 specioj), de *Platymonas* kaj de *Euglena*; kelkaj estas senflagelaj, aliaj ankorau flagelohavantaj. Gis nun oni ne sukcesis restarigi moveblecon per aldono de kemiajoj au celekstraktajoj. Ce *C. moewusii*, dum kunfandigas seks-celoj de certaj malsamaj paralizaj rasoj, la flageloj reakiras moveblon per reciproka intersango de perantoj inter la bazaj granetoj. Simila rezulto estas observita ce *C. reinhardi,* malgrau la plia rapideco de la kunfandigo. La movon de la flageloj ce *C. moewusii* kontrolas almenau 7 genoj, distribuitaj en 6 kromosomoj. Unu *par* geno estas seksligata. Tetrad-analizoj indikas ke 4 el la lokoj situas tre proksime al siaj centromeroj. Retromutacioj, kiuj restarigas la moveblecon, okazas cu samloke, cu rezulte de modifa geno *mod.* Tiaj *mod* genoj sajnas esti specifikaj por la ceteraj *par* lokoj; jen plua elmontro ke pluraj apartaj procedoj regas la movojn de flageloj.

LEWIS, HARLAN, and PETER H. RAVEN. University of California. *Phylogeny of the Onagraceae.* Cytological and genetic studies have contributed greatly to our understanding of phylogeny in the family Onagraceae at all levels from the relationship of genera to the differentiation of conspecific populations. At the generic level the contributions of cytology have been notable even when direct genetic evidence from hybridization cannot be obtained. For example, cytological evidence suggests that not only are *Epilobium* and *Zauschneria* closely related, but also the section of *Epilobium* from which the latter has probably arisen. On the other hand, cytological observations provide strong evidence that the morphological similarities in the fruit of *Gaura* and *Heterogaura* that have led some authors to consider them congeneric are parallel specializations without phylogenetic significance. At the same time, cytological evidence and genetic evidence taken together leave no doubt as to the congeneric status of *Clarkia* and *Godetia.* At the interspecific level, cytological and genetic evidence has made an outstanding contribution to an understanding of phylogenetic relationships in *Clarkia* and *Oenothera.* In *Clarkia* it has been possible to show in some instances the direction as well as the cytological and genetic basis of phylogenetic change resulting in species formation at the diploid level. It has also been possible to demonstrate polyploid phylogenies by resynthesis. In *Oenothera,* not only has the relationship between diploid species of Euoenothera been demonstrated, but also the phylogenetic sequences of chromosome arrangements that are involved to the formation of the famous races comprised of translocation heterozygotes.

LEWIS, HARLAN. *See* MOSQUIN, THEODORE

LIBBERT, EIKE. Humboldt-Universität, Berlin. *Chromatography of the Enzymatic Generation of Auxin from Tryptophane Changed by an Endogenous Inhibitor.* An enzyme system converting tryptophane to 3-indoleacetic acid (IAA) was extracted from pea plants. Small quantities of enzyme were applied to tryptophane in order to retard enzymatic conversion and to interrupt it at different times. Reaction products were chromatographed in different solvents and sprayed with different colour reagents. IAA occurs as late as 6 hours after incubation. Previously, the occurrence of only one acidic indolic substance could be demonstrated taking place one hour after incubation. It has not been identified till now. There are several substances occurring later than IAA, particularly in the ether insoluble fraction. The addition to the reaction mixture of ether extract containing a substance for correlative inhibition rigorously inhibits the occurrence of IAA but stimulates the gain of the unknown intermediate. It is concluded that the extract containing correlation inhibitor partly blocks the generation of IAA from the unknown intermediate. A compound giving some strong colour reactions (especially with potassium ferricyanide in the nitric acid) and running close to the inhibiting principle during chromatography was found in the inhibitor extract but could not be demonstrated as being identical with the inhibiting principle.

LIBBERT, EIKE. Humboldt-Universität, Berlin. *Some Special Aspects of the Function of Endogenous Growth Inhibitors in Dormancy.* It is concluded that dormancy and correlative inhibition are related phenomena. During the season correlative inhibition changes to dormancy in woody species. This occurs as a result of enrichment of the correlation inhibitor in the buds and perhaps of a chemical change in the molecule of the inhibitor, a change from a non-acidic to an acidic state for instance. In tubers and seeds similar phenomena are supposed to occur. The inhibitors concerned in correlative inhibition and in dormancy are supposed to block different enzymatic activities, perhaps by inactivating essential sulfhydryl groups. Amylase and the enzyme system converting tryptophane to indoleacetic acid are among the enzyme systems which are influenced by the inhibitors. Perhaps an enzyme system generating gibberellin-like material may be influenced in the same manner. The manner of removal of the inhibitors by special environmental influences is still unknown. There are other inhibitors concerned in dormancy not related to correlative inhibition (especially in seeds) and other factors leading to dormancy besides the occurrence of inhibitors.

LIEBERMAN, MORRIS. U.S. Department of Agriculture. *Oxidative Activity of Cytoplasmic Particles from Apple Fruits.* Cytoplasmic particles isolated from apple fruit show major characteristics of mitochondria. They exhibit an electron transport system that can transfer electrons from reduced diphosphopyridinenucleotide (DPNH) to oxygen, and also can oxidize pyruvic acid and all the Krebs cycle intermediates. The difficulty previously experienced in isolating mitochondria from apples can be attributed to two factors. One is the very low protein content of the apple preparation and the other is the high concentration of inhibitory substances, notably polyphenols, which are found in the homogenate. Another important consideration in the isolation of mitochondria from apples is the use of alkaline medium in the homogenization procedure. A medium containing 0.2 *M* sodium carbonate, .25 *M* sucrose, .01 *M* ethylenediaminetetraacetic acid at pH 10.2 was very effective for the isolation of particles showing electron transport and Krebs cycle activity. Homogenizing media containing Tris buffer at pH 9.2 and phosphate buffers at pH 8 and 7 were far less effective in yielding active cytoplasmic particles. The data will provide evidence for electron transport involving DPNH oxidase, cytochrome c reductase, cytochrome oxidase, and also Krebs cycle activity derived from oxidation of intermediate acids and interconversion of Krebs cycle acids. The changes in mitochondrial activity during development of the fruit will also be considered.

LIER, FRANK G. Columbia University. *Studies on the Origin, Development, and Cell-Wall Structure of the Phellogen in Pelargonium Stems.* Phellogen cells in *Pelargonium* are elongate in a direction parallel to the stem axis and have a rectangular outline in cross-section with a shorter radial than tangential dimension. A possible relationship exists between living hairs and the onset of phellogen divisions. The phellogen has its origin in the subepidermal cells and two stages of division were noted. One is found in the apical bud, but this is not associated with normal phellogen activity. A later series of divisions occurred at approximately 400 microns from the apex. These were associated with the formation of cork and phelloderm. Nearness of cells to stomata was not a factor in initiating divisions. There were more divisions in the middle than at the tops of the internodes in early stages when the phellogen activity was limited to scattered areas around the stem. Orientation studies showed that there tended to be more divisions on one side of the stem rather than equal activity around the circumference. The possible effect of light on this orientation will be discussed. Electron-microscope investigation of subepidermal and phellogen cell walls showed a loose, scattered, granular deposit, similar to suberin as shown in other studies, upon the cellulose microfibrils.

LIETH, HELMUT VON, und MANFRED VOGT. Botanisches Institut der Landwirtschaftlichen Hochschule, Stuttgart-Hohenheim. *Der Lichtkompensationspunkt einiger Waldschattenpflanzen im Sommer und im Frühjahr.* Mit einer früher beschriebenen Methode (Lieth, 1958; Pavletic und Lieth, 1958) haben wir im Frühjahr und Sommer 1958 Lichtkompensationspunkte an 20 verschie-

denen Waldschattenpflanzen bestimmt. Dabei stellten wir fest: (1) Bei allen geprüften Arten liegen im Frühjahr vor der Belaubung die Kompensationspunkte bei relativ hohen Beleuchtungsstärken (800-1,000 Lux einer Quecksilberhöchstdrucklampe). (2) Während der Laubentfaltung, die Anfang Mai begann und sich etwa über 3 Wochen hinzog, sanken die Werte bis auf 100-200 Lux ab. In der gleichen Zeit fiel der Lichtgenuss am Standort von 60-80% auf 5-10% der Ortshelligkeit. (3) Bis zum Ende unsercr Messungen im Juli blieb die Lichtkompensation gleich, abgesehen von kleineren Schwankungen. Einige Arten zogen während der Untersuchungsperiode ein; deren Kompensationspunkte stiegen dann wieder an; gleichzeitig vergilbten ihre Blätter. Die geschilderten Verhältnisse sind in Abb. 1 wiedergegeben. In dieser Abb. sind die Messwerte folgender Arten zusammengefasst: Arum maculatum, Allium ursinum, Anemone nemorosa, Asarum europaeum, Aegopodium podagraria, Carpinus betulus, Convallaria majalis, Fagus silvatica, Lonicera xylosteum, Lamium galeobdolon, Primula elatior, Paris quadrifolia, Prunus padus, Ranunculus ficaria, Ranunculus lanuginosus, Scilla bifolia, Stellaria holostea, Urtica dioica, Viola silvestris und ein einzelner Wert von Carex silvatica. Parallel zu den Kompensationspunkten haben wir die Dunkelatmung nach der bei Lange (1953) beschriebenen Methode gemessen. Dabei fanden wir, dass sich die Dunkelatmungsrate aller untersuchten Arten in der gleichen Weise ändert, wie der Lichtkompensationspunkt. In Abb. 2 ist das am Beispiel von *Asarum europaeum* dargestellt. Wenn man die Skalenwerte (Lux für den Kompensationspunkt und mg. $CO_2/g._{Tg}.$ h für die Dunkelatmung) so aufträgt, dass 150 Lux einem mg. CO_2 entsprechen, dann bringt man beide Kurven nahezu zur Deckung. Daraus geht hervor, dass das Absinken der Kompensationspunkte während der Belaubung in erster Linie auf einer Senkung der Atmungsintensität beruht und nicht auf einer stärkeren assimilatorischen Leistung. Das Verhältnis Kompensationspunkt/Dunkelatmung (Lux/1 mg. CO_2) liegt bei den untersuchten Arten in der gleichen Grössenordnung. Z.B.: Asarum europaeum 150, Anemone nemorosa 150, Carpinus betulus 150, Ranunculus ficaria 150, Viola silvestris 130 und Allium ursinum 100. Die Atmung während des Einziehens wurde bei Allium ursinum näher untersucht. Auch hier zeigte sich eine Parallelität zum Anstieg der Kompensationspunkte, sowie dem Grad der Vergilbung.

LINDEGREN, CARL C. Southern Illinois University. *Segregation of Transmissible Factors among the Progeny of Hybrids.* Critical proof that the chromosomes transmit hereditary factors from parent to offspring was first presented by Bridges as a result of the genetical analysis of attached "X" *Drosophila,* thus establishing the genome as an independent hereditary apparatus. Evidence presented in the same paper proved that crossing-over occurred when four strands were present and indicated the necessity for tetrad analysis to distinguish chromatid and chromosomal interference. Renner demonstrated that the chloroplasts were transmitted as autonomous particles from parent to offspring, and established the plasmone as an independent hereditary apparatus. In this symposium we shall consider the mechanisms of transmission of both plasmonal and genomal characteristics. The wide acceptance of the phenomenon of gene-conversion, first demonstrated by Renner, has made the interpretation of the conventional Mendelian analysis more difficult. Tetrad analysis has minimized the ambiguities involved in studying the behavior of the chromosomes in meiosis. We have chosen, therefore, to discuss (1) tetrad analysis in higher plants and (2) in the fungi, (3) the

phenomenon of irregular segregation demonstrated by tetrad analysis, and (4) the current information on the segregation of plastids and other cytoplasmic granules.

LINDENMEYER, PHILIPP. *See* ZUCK, ROBERT K.

LINDER, ROBERT. Institut de Botanique, Strasbourg. *Incompatibilité et rapports interspécifiques: Oenothera fruticosa–O. pumila. Oenothera fruticosa* est autostérile du fait d'incompatibilité (suivant le mécanisme connu d'allèles d'opposition S); la fécondation croisée obligatoire maintient une variation importante à l'intérieur de l'espèce. *O. pumila* est autofertile; le type spécifique très constant montre beaucoup de ressemblance avec le type moyen de *O. fruticosa.* C'est seulement dans le sens *pumila* × *fruticosa* que les croisements expérimentaux se font généralement avec succès. On peut dire, en première approximation, que l'incompatibilité joue un rôle dans la constitution de la barrière interspécifique de stérilité. Il est possible de mettre en évidence un comportement individuel de plantes dont le génotype commande les possibilités de fécondation. Ce mécanisme des facteurs S d'incompatibilité peut jouer dans les deux sens. C'est donc que, dans certains individus, des allèles S d'opposition produisent l'inhibition de pollen correspondant, en provenance de l'autre espèce; c'est l'indication que le génotype des deux espèces comporte des allèles S identiques. Ces faits concernant *O. fruticosa* et *O. pumila* conduisent à l'étude de la manière dont s'établit le mécanisme factoriel S de l'inhibition dans le jeu normal de l'incompatibilité.

LINDSAY, D. W. *See* VICKERY, ROBERT K., JR.

LINSKENS, H. F. R.K. University, Nijmegen, Netherlands. *Biochemical Aspects of Incompatibility.* The biochemical mechanism of incompatibility which has been investigated so far concerns the inhibition of pollen germination on the stigma and the inhibition of the growth of pollen tubes in the style. According to recent investigations (Christ, Kroh, Oehlke), the inhibiting reaction on the surface of the stigma may be due to a blocking of an enzyme system which causes the fermentative breakdown of the cuticle, thus enabling the tube to penetrate. The inhibition of pollen-tube growth in the conducting tissue is morphologically characterized by a vesicular swelling of its apex, condensation of the micellary structure, and an increased deposition of carbohydrates in the form of thick layers of callose. Connected with this are an increased respiration rate, enhanced adsorption (Schloesser), and changes in enzyme activity. By way of electrophoresis and the ultrocentrifugation, protein fractions can be obtained that arise only in connection with the incompatibility reaction and have not been formed previously. These compounds are glucoproteids and built up by both sexual partners together (labeling with P^{32} and C^{14}). For the time being they will be designated as "ward-bodies." By serological tests of extracts of pollen and styles (Oenothera: Lewis; Petunia: Linskens), it could be shown that the homologous reactions are stronger than the heterologous. On the strength of the experimental results available, the inhibition of the pollen-tube growth is considered as a disturbance of the metabolic relation between the sexual partners before the moment of fertilization. It might proceed in the way of an immunity reaction; whereas a disturbance of the carbohydrate metabolism could be considered as a secondary effect.

LINTEAU, ANDRÉ. Quebec City. *Is There a Common Platform for the Various Ecosystems?* Ecology admittedly is the necessary basis of sound silviculture. In order, moreover, to acquire a clear understanding of forest stand organization, recourse must be had to the technique provided by phytosociology. If, on the other hand, plant communities are to be set within the proper framework, physiographic and climatic regions should be known in advance. One must not forget, however, that the object of the silviculturist is the life which develops at or near the surface, that is, that of vegetation and soil. The systematic study of plant associations leads to the knowledge of the various biocenoses. It would be an endless task to proceed the other way by determining first the kaleidoscopic manner according to which the site factors combine locally and regionally to give rise to the various stand conditions. In this process it would nearly be impossible to take account of each and all the factors as well as to evaluate the part played by the biological agencies in the modification of the environment. The experience acquired in Quebec in the last twenty-five years demonstrates beyond doubt that the simultaneous determination and classification of the plant communities and of the related soil profiles constitute a sure basis for the knowledge of the ecology and productivity of the forest stands. In this respect, any of the analytical methods proposed by the various schools of thought is convenient. If, however, an over-all picture of the regional vegetation is to be obtained it is necessary to make a synthesis of all the data pertaining to sub-associations, variants, and associations, and thus evolve an ecosystem which establishes a complete hierarchy of the communities. To this end, the system proposed by the Zurich-Montpellier School is the only one which offers this possibility.

LIOGIER, ALAIN. La Habana, Cuba. *The Probable Origin of the Flora of Cuba.* Cuba, the greater of the Antilles, lying across the Gulf of Mexico, at the crossroads of the Americas, has a very interesting flora. Though in the tropical region, it has species from sub-tropical and temperate North America; the main group is Antillean, with strong affinities with the flora of Central America and that of the northern part of South America, namely Colombia and Venezuela. A very few elements of this flora came, in past geological epochs, from the Mediterranean and Africa, and we have even some Asiatic elements that probably came through the Northern Pacific connections in the Mesozoic. Though very little has been done in the field of Cuban paleobotany, the distribution of the modern plants suggests that the bulk of the flora came chiefly from South America through Central America, during the Mesozoic and the Cenozoic, when Cuba and Jamaica were united with Honduras. We must admit as well a connection with Florida, and another with Yucatan, while the Antillean flora was formed by evolution of the former immigrants. Few plants have come through the lesser Antilles. The endemism of the flora of Cuba is about 50 per cent, and this figure, the highest in the Antilles, is due to Cuba's long isolation.

LIORET, CL. Laboratoire de Photosynthèse du C.N.R.S., Gif-sur-Yvette, France. *L'Utilisation de la chaîne carbonée de l'acide glutamique par des tissus de plantes supérieures.* Des colonies tissulaires de "crown-gall" de Scorsonère et des boutures de feuilles de *Bryophyllum daigremontianum* Berger sont alimentées pendant quelques heures avec de l'acide glutamique marqué par ^{14}C soit en 1 soit en 3 et 4. L'analyse des différentes substances radioactives trouvées dans les tissus a permis d'évaluer l'importance relative des 5 voies principales d'utilisation de l'acide glutamique. (1) Perte de la fonction aminée avec formation d'acide α-cétoglutarique: 40 à 60 pour cent de l'acide glutamique transformé. L'acide α-cétoglutarique est ensuite soit décarboxylé avec genèse des diacides tétracarbonés, soit carboxylé avec formation d'acides citrique et isocitrique. (2) Formation de glutamine: 25 pour cent dans les tissus de crown-gall et les feuilles de *Bryophyllum* et 2 pour cent seulement dans les racines de *Bryophyllum.* (3) Décarboxylation avec formation d'acide γ-amino-butyrique: 21 pour cent dans les tissus de crown-gall et les racines de *Bryophyllum,* 6 pour cent dans les feuilles de *Bryophyllum.* (4) Réduction en γ-semialdéhyde avec genèse de proline et d'arginine: 12 à 19 pour cent dans les boutures de *Bryophyllum,* 3 à 5 pour cent dans les tissus de crown-gall. (5) Intégration directe de la molécule d'acide glutamique dans les protéines: toujours 3 à 6 pour cent de l'acide glutamique transformé.

LIPETZ, JACQUES. Yale University. *The Possible Role of Indole Acetic Acid Oxidase in Tumor Induction.* It is fairly well agreed that incipient tumor cells are promoted to form tumors only if auxin is present in sufficiently high concentrations. Studies by Braun and others have shown that the A66 mutant of *Agrobacterium tumefaciens* can induce tumors only if the auxin level in the host plant is raised by exogenous auxin application. There is no agreement in the literature about correlations between virulence of bacteria and auxin production. Studies with parallel tissue cultures derived from sunflower stem tissue inoculated with virulent and with avirulent bacteria show that there is a marked drop in the level of IAA oxidase two to three days after inoculation with the virulent but not the avirulent bacteria. This drop is evident with either the A66 or the 2BV7 virulent strain. Attempts to induce tumors with the avirulent 2BNV6 strain in plants with exogenously raised IAA levels were unsuccessful. It is suggested that the 2BNV6 strain, unlike the A66 strain, is deficient in more than one character necessary for tumor induction. It is also suggested that the IAA level needed for transformation may result from decreased IAA destruction by the infected tissue, rather than IAA from the bacteria.

LIPPINCOTT, JAMES A., BARRY COMMONER, and JANEY S. SYMINGTON. Washington University, St. Louis, Missouri. *Experiments on the Linear Synthesis of TMV.* Previous work from this laboratory has demonstrated that it is possible to remove successive segments of protein and nucleic acid from one end of a tobacco mosaic virus (TMV) rod. The experiments to be described utilize this procedure in conjunction with C^{14}-labeled virus. From such data the relative rates of synthesis of TMV-protein and TMV-nucleic acid have been obtained for both the whole virus and for various linear segments of the virus. These results may be used to describe the way in which virus particles are assembled in the infected host cell.

LITTLE, ELBERT L., JR. Forest Service, U.S. Department of Agriculture. *Distribution Maps of United States Trees.* Natural ranges of about one hundred important tree species of the United States have been mapped by lines on base maps with county boundaries. Distribution outside the country is shown also. Sources consulted include state distribution maps published and unpublished, state and local floras, forest-type and vegetation maps, Forest Service unpublished maps, and herbarium specimens. Before formal publication, review and correction of the preliminary maps are invited. Mapping of additional tree species is in progress.

LITTLE, RUBY R. U.S. Department of Agriculture. *Microscopic Studies of Rice* (*Oryza sativa L.*) *Varieties.* Twenty-five varieties of rice (*Oryza sativa* L.) were studied microscopically during investigations aimed at developing small-quantity methods for understanding and predicting cooking behavior. Treated sections and starch were examined in bright-field, polarized, and phase-contrast illumination. The demonstration includes untreated and treated samples, photographs, and photomicrographs in color and in black and white. The pericarp and aleurone are separated, except at the dorsal ridge, by a double sheath stainable with fat stains. Aleurone grains are covered with a fat-stainable sheath which is ruptured in cooked rice disclosing a birefringent body within, a characteristic not visible in uncooked rice. The tissue contiguous to the embryo consists of endosperm cells, depleted of starch and crushed; small protein bodies remain sandwiched between cell walls, which exhibit characteristics of pectin and cellulose. Immediately next the endosperm, cells are depleted of starch and contain small protein bodies but are not crushed. Pericarp, aleurone, starch, protein, and endosperm cell walls are arranged so as to predispose different patterns and degrees of longitudinal dehiscence during cooking. Dehiscence patterns in cooked brown rice differed from those in cooked milled rice. Starch gelatinization induced by chemical and heating treatments was observed and photographed in phase contrast.

LLANO, GEORGE A. National Academy of Sciences, Washington, D.C. *Lichens of the Antarctic.* The author reports on the lichenological studies carried out in the Antarctic in 1957-8 under the auspices of the USNG-IGY, and on the continuing program recommended by the Committee on Polar Research, National Academy of Sciences, in biological sciences. Results of the 1957-8 field work include analysis of habitats in the NAF, McMurdo Sound, and Vincennes Bay region, Antarctica, as well as a summary of the geographical distribution of Antarctic cryptogams.

LOCHHEAD, A. G. Microbiology Research Institute, Canada Department of Agriculture. *Associations and Symbiosis between Micro-organisms in Soil.* The existence of a microbiological equilibrium in soil, generally admitted, implies inter-relations between members of the micropopulation. In a densely populated environment, such as arable soil, there is evidence of a widespread influence of groups of organisms upon other groups, all in a maze of cross-relations. The net result of such influences, which include not only antagonisms, but also stimulative effects or provision of essential substances, is a balance which, though constantly fluctuating under diverse environmental factors, appears to be characteristic of a given soil and not readily upset. Associative and symbiotic effects are related largely to the nutritive needs, as well as to the metabolic patterns and synthetic capacities of groups of micro-organisms. In addition to the more obvious examples of association and symbiosis related to the "classical" physiological groups of soil organisms, there is evidence that growth-promoting substances play an important role, one that may be modified or intensified in the rhizosphere.

The implications of some aspects of associative action related to vitamins and other microbial growth factors are discussed.

Lockhart, James A. California Institute of Technology. *The Intracellular Mechanism of Stem Growth Inhibition by Visible Radiation.* Investigations with *Pisum sativum* (var. Alaska) show that stem growth inhibition begins approximately 100 min. after the onset of red irradiation. Physical characteristics of the growing region of the stem have been examined 60 min. after the onset of inhibition and compared to etiolated tissues. The average osmotic concentration of the cells and the permeability of the cells to water were found to be unaffected by the inhibitory irradiation. The plasticity of the irradiated tissue is markedly less than the plasticity of dark-grown plants. The decrease in plasticity closely parallels the decline in growth rate. The rigidity of the cell walls of irradiated tissue (measured when plasmolysed) is also much greater than the rigidity of the walls of dark-grown plants. It is concluded that visible radiation inhibits stem growth through a reversal or prevention of the normal cell wall plasticity.

Lockhart, James A. California Institute of Technology. *Post-dark Period Processes in the Leaves of Short-day Plants.* After the end of an inductive dark period, a change ("stabilization") takes place in the nature or form of the floral hormone in short-day plants. This stabilization is measured by the appearance and subsequent disappearance of an extremely heat-labile stage. Stabilization is promoted by high intensity light (and apparently by sucrose feeding: Carr, 1957) in *Xanthium*; while in *Pharbitis* the change proceeds readily in continuous darkness (Nakayama, 1953). These changes occur before the final hormone begins to move from the leaf. In *Xanthium*, added 3-indoleacetic acid (IAA) acts to prolong the heat-labile stage, although IAA does not affect translocation of the final hormone. During the heat-labile stage the hormone (precursor) has not been found to be protected by leaf applications of: anti-auxin, 2,4,6-trichlorophenoxyacetic acid, sucrose, ascorbate, cysteine, methionine, thiouracil, adenine, adenosine, or guanosine. "Stabilization" takes place readily at low (4° C.) temperature (Lockhart and Hamner, 1954). Partial destruction of the labile precursor may take place at normal greenhouse temperatures in light. This may account for the shortening of the apparent critical dark period by return to light at low temperatures after the dark period (de Zeeuw, 1957).

Lodge, R. W., J. Looman, and J. B. Campbell. Canada Experimental Farm, Swift Current, Saskatchewan. *Phytosociological Investigations: Their Value in Classifying Western Canadian Grasslands.* The Western Canadian Grasslands are examined using phytosociological methods and are tentatively classified. The sociological associations are compared with the generally recognized ecological classification. Faciations of the *Stipa-Bouteloua* mixed prairie and the *Festuca* associations are assigned sociological rank. A constellation of the species of the several sociological associations is presented to show their grouping. The five distinct groups in the constellation — the *Eriogonion, Boutelouion, Stipeto-Festucetalia, Danthonetalia,* and *Calamogrostetalia* — are discussed in relation to the environment. The relations of these groups to edaphic factors, pH, moisture-holding capacity, soluble salts, H ion, and OH ion concentration are examined. The value of these gross measures is shown, as is their limitation in explaining the finer distinction of associations within one alliance. The possibility exists that the requirement for one or more ions differs. To test this possibility soils were tested for water soluble K, Na, Ca, and Mg. The results of chromatographic analyses of soils for these ions are presented. The differences in cation content of the soil solution between certain communities are shown, and the value of the method to detect fine differences is shown to be limited.

LOEGERING, WILLIAM Q. U.S. Department of Agriculture. *Physiologic Specialization in the Rust Fungi and Its Relation to Changes in Varietal Reaction.* The development and release of new rust-resistant cereal varieties, during the past half-century or more, usually have been followed sooner or later by the appearance of a race or races of rust which cause severe losses in those varieties. To attack a resistant variety, these races must possess a gene or combination of genes that condition a susceptible type infection. Such a gene may arise by mutation or may be present in the rust population as a recessive in a heterozygous condition. The genes for a necessary combination may also be present in the rust population but not in a single biotype. Through hybridization or asexual mechanisms the mutant or existing genes conditioning a susceptible type infection may be uncovered or brought together in the appropriate combination. On the other hand, virulent genotypes may have existed undetected in the original rust population. Regardless of their origin, the emergence of races which condition a susceptible type infection on a previously resistant variety of a cereal is due to the selection pressure of the variety against prevalent and avirulent genotypes in the rust population and subsequent increase of the races is due to selection pressure in their favor.

LOEWUS, F. A. U.S. Department of Agriculture. *Synthesis of Ascorbic Acid from Glucose.* The conversion of D-glucose to L-ascorbic acid has been studied in the detached ripening strawberry (*Fragaria*) fruit with the aid of C^{14}-labeled compounds. Glucose-1-C^{14}-, -2-C^{14}-, or -6-C^{14}-labeled berries yielded ascorbic acid in which about 70 per cent of the C^{14} in the carbon chain of ascorbic acid resembled that found in the galacturonic acid residues from the cell-wall substance and the free hexose sugars from the same berries. All of these constituents conformed to patterns characteristic of hexose phosphate metabolism. These experiments have been interpreted as evidence that ascorbic acid can be formed from glucose without cleavage of the carbon chain and in such a way that the aldehydic carbon of glucose is converted to the carboxyl carbon of ascorbic acid. Neither glucuronic nor galacturonic acid nor their lactones appear to be intermediates in this conversion. Experiments with D-glucuronolactone-1-C^{14} or -6-C^{14} have revealed the presence of a second non-phosphorylated pathway to ascorbic acid in which the latter became labeled exclusively in carbon 6 or carbon 1, respectively. Intermediates involved in this conversion have not yet been identified. Other major end products were CO_2, D-xylose, and an uncharacterized aldonic acid. The xylose became labeled only when glucuronolactone-1-C^{14} was the source and then only in carbon 1. The metabolic significance of these conversions will be discussed.

LOMMASSON, ROBERT C. University of Nebraska. *Grass Leaf Venation.* The value to systematic classification of characteristics such as relative number of major veins which arise from the midrib, the abundance of interpolated veins and their position in the blade, and the manner of termination of major veins are given. There are other characteristics readily obtained from sections of the blade that are also of systematic value. These include vein size or volume, vein spacing, relationship of veins to mesophyll, vein structure and associated mechanical tissue, bundle sheaths and chlorenchyma, bundle sheath structure and prominence.

LONA, FAUSTO. Institute of Botany, Parma. *The Place of Gibberellin and Auxin in Flower Initiation.* The developmental activities of gibberellin, auxins and kinetin, together with those of antiauxins and cell-division inhibitors, are examined in their relations to external factors (notably light and temperature conditions). The action of these substances on (*a*) general ontogenetic processes, (*b*) photoperiodical flowering induction, and (*c*) flowering expression is discussed. Some recent experiments performed under various climatic conditions now give us a better picture of the various modes of action of gibberellin and other substances upon plant development. Since nearly all substances that were found to be positively or negatively active on flower initiation are in some way distinctly active on cell division, their role on the conclusive cyto-hystological flowering processes is principally considered. Similar substances are retained as an integral part of the material assemblages operating more or less directly on the shoot apical meristems and supplied by physiologically distinct (anthotrope and vegetotrope) organs.

LONG, ROBERT WILLIAM. Ohio Wesleyan University. *Hybridization, Introgression, and Population Structure of Two Eastern United States Species of Helianthus (Compositae). Helianthus giganteus* L. and *H. grosseserratus* Martens are two common, perennial sunflowers of the Eastern United States. The former appears to be centered around the Great Lakes Region in wet places; the latter is found in the prairies of Iowa and Illinois. Post-glacial migrations have resulted in their coming into contact in Indiana and Ohio where interbreeding occurs. Hybrids become established in areas of moderate ecological disturbance, leading to wide-spread introgression. This greatly modifies populations of both species but apparently does not result in species amalgamation. Evidence from several lines of investigation has been brought to bear on this problem, including hybridization experiments, transplant studies, natural population sampling and analyses, cytological observations, and herbarium work.

LOOMAN, J. *See* LODGE, R. W., *et al.*

LOOMIS, W. E., and R. H. SCHIEFERSTEIN. Iowa State College. *Growth and Differentiation of the Epidermal Wall.* If primarily the outer epidermal wall of a typical mesophytic angiosperm leaf is considered, the growing cells show an outer cuticular covering by the time the bud opens and probably before. If the cuticle is removed from the young, growing leaf by chemical or enzymatic treatment, it separates in cell-sized flakes rather than sheets. Electron micrographs show breaks in the cuticle at the margins of the cells, and wax and cellulose patterns indicate that the upper wall of the epidermal cells grows from the margins. In species in which surface wax deposits form, the soft wax is extruded through the youngest wall of the growing cells. No wax pores or channels can be observed through the cuticle or outer wall when the wax is dissolved. Surface wax weathers from older leaves and is not replaced. Sub-surface wax may increase during the life of the leaf. If the cuticle of a recently matured leaf is treated with pectinase, it can, in many species, be removed in large, cellulose-free sheets. The outer layers and frequently the entire outer wall become impregnated with cutin and wax as the leaf ages. The cuticular layer of *Hedera helix* remained slightly but uniformly permeable to water from near maturity to senility. Permeability to 2,4-D, however, decreased fifty times.

LOPEZ, M. ARNALDO. Universidad Nacional de Trujillo, Peru. *Anatomia de plantas vasculares pertenecientes al folklore medicinal peruano.* Se hace un estudio anatomico de los organos vegetales principalmente de aquelles que tienen use en medicina popular, de 20 especies que habitan en los Andes peruanas. Se acompanan en cada caso con microfotografias de estudios, asi como reforesentaciones esquematicas tomadas de campos microscopicos. Las especies son: (1) *Embothrium grandiflorum;* (2) *Ranunculus gusmanii;* (3) *Ranunculus polystichus;* (4) *Laccopetalum giganteum;* (5) *Capparis augulata;* (6) *Capparis ovalifolia;* (7) *Coriaria thymifolia;* (8) *Gentianella graminea;* (9) *Gentianella thyrsoidea;* (10) *Rauwolfia odontophora;* (11) *Verbena littoralis;* (12) *Vallesia dichotoma;* (13) *Minthastachys mollis;* (14) *Valeriana primatifida;* (15) *Posophyllum ruderale;* (16) *Baccharis lanceolata;* (17) *Flaveria bidentis;* (18) *Chuquiraga weberbaneri;* (19) *Tessaria integrifolia;* (20) *Picsosia longifolia.*

LOSADA, M. *See* TREBST, A. V., *et al.*

LOUGHHEED, T. C. Insect Pathology Research Institute, Sault Ste. Marie, Ont. *The Influence of Certain Factors on Sporulation of Hirsutella gigantea Petch.* This fungus, when isolated from its natural insect host (*Choristoneura fumiferana* Clem.), can be grown in pure culture on Sabouraud maltose agar, but it does not sporulate on this medium. In an investigation of the factors influencing sporulation, the effect of carbon and nitrogen sources, and of the carbon:nitrogen ratio, has been determined. It was also found that unknown factors contained in a crude glucose preparation had an effect on synnemata formation and the production of spores. An unidentified "black yeast" also stimulated the sporulation of *H. gigantea* when grown in mixed culture. The influence of organic phosphates was tested. A number of physical factors were found to influence sporulation. Temperature and light greatly affected the production of synnemata while the presence of a physical barrier led to spore formation directly on the mycelium.

LOUIE, RAYMOND. *See* YARWOOD, C. E.

LOURTIOUX, ANDRÉE. *See* CHOUARD, PIERRE

LOVE, R. MORTON. University of California. *Interspecific Hybridization in Stija L. III, S. cernua × S. leucotricha.* Chromosome behavior was studied in this artificially produced hybrid. As expected $2n = 49$ (in *cernua* $2n = 70$ and in *leucotricha* $2n = 28$). The hybrid is sterile. Fifty pollen mother cells were analyzed at first meiotic metaphase. Pairing behavior in the hybrid may be summarized as follows: univalents varied from 18 to 35 (average 24.16), bivalents from 7 to 15 (average 11.50), trivalents from 0 to 2 (average 0.52), quadrivalents from 0 to 1 (average 0.02), and quinquivalents from 0 to 1 (average 0.04). On the basis of previous evidence, Love (Am. J. Bot. *41*:107-110, 1954) has drawn up tentative genomic constitutions of three species related to *leucotricha* in the section Stephanostipa (Elias, Geol. Soc. Am. Spec. Papers *41*:1-176, 1942): *lepida* 14A, 3B; *pulchra* 14A, 3B, 150; and *cernua* 14A, 21D. It appears that *cernua* and *leucotricha* have 14 chromosomes in common. A decision as to whether these are A or D chromosomes awaits hybridization of *lepida* and *pulchra* with *leucotricha*.

LOWTHER, J. STEWART. *See* ARNOLD, CHESTER A.

LOWTHER, RUTH L., and W. G. BOLL. McGill University, Montreal. *A New Rooting Test and the Effect of Ethionine on Rooting.* Ethionine, an antimetabolite for methionine, shows growth stimulatory and morphogenetic effects on excised tomato roots including an increase in the emergence of lateral roots (Boll, Abstract, Ann. Meeting Am. Soc. Plant Physiologists, 1954). This paper describes a new rooting test and the effect of ethionine on rooting. The rooting test uses partially decotylised, etiolated bean hypocotyls. The test can be performed in the laboratory and does not require exogenous nutrients. The response to exogenous indoleacetic acid is quantitative. Ethionine increased the rooting. In view of the lack of a simple rooting test, suitable for the laboratory, the test used here should prove of general interest.

LUCK-ALLEN, E. ROBENA. University of Toronto. *Resupinate Tremellaceae of Ontario.* Approximately five hundred specimens of resupinate Tremellaceae from Ontario have been identified. Twenty-eight species distributed in six genera are represented. *Heterochaetella* includes three species, one of which is new, the other a variety raised to specific rank. *Stypella* is represented by two species. *Sebacina calcea* (Pers.) Bres. is transferred to *Eichleriella*. The genus *Sebacina* is used in a restricted sense to include seven species, four of which occur in Ontario. One of these is described as new. *Exidiopsis* is represented by nine species from Ontario, one of these being described as new. The genus is divided into three subgenera and includes *Bourdotia galzinii*. Since this species is the type of the genus *Bourdotia*, a new generic name with two new subgenera is proposed for nine Ontario species. Three of these are described for the first time. Two additional species occurring outside Ontario are included in this genus.

LUIPPOLD, HELEN J. *See* HABER, ALAN H.

LUKAS, ELSA. Thaya, Austria. *The Relation of Osmotic Value to the Drought and Frost Resistance of Various Plants.* An investigation was undertaken to determine how much the osmotic value of certain organs of one plant changes in the course of the plant's development, and how this change is related to drought and frost resistance in the mature state. Results indicate that (1) during the whole period of development there is a close connection between osmotic value and water loss and these always change in inverse proportion; (2) this relation between osmotic values and water loss can be recognized individually in the stems, leaves, and blossom, but in one plant, at a given moment, the osmotic value and the loss in weight are not the same in all organs; (3) the osmotic value and the capacity to retain water undergo adaptation to external factors; (4) it is striking that it was among the Liliaceae that forms with special resistance to drought and cold and also with high osmotic values were found, and among many wild plants of this family I found considerably higher osmotic values at any season than in any other plants in the same field. Photomicrographs of the cells of plants plasmolysed with dextrose, KCl, NaCl, and $CaCl_2$ illustrate these findings. Since the cells of plants resistant to cold and drought also show the highest osmotic values, this is an indication that one is probably dependent on the other.

LUMRY, RUFUS. *See* MAYNE, BERGER C., *et. al.*

LUNDQVIST, ARNE J. A. University of Lund, Sweden. *Self-incompatilibility in Rye (Secale cereale L.).* The incompatibility system in rye involves two independently inherited, probably multi-allelic loci, named S and Z, both with gametophytic action in the pollen. In contrast to systems with a one-locus gametophytic determination of the pollen specificities, this system is unimpaired by polyploidy. The persistence of incompatibilities at the polyploid level in the two-loci system may indicate a duplicate origin of the two loci but may also find an explanation in the fact that the two loci elaborate the incompatibility specificities in a complementary way. This successful cooperation between two multi-allelic loci seems to imply only small differences within each of these loci, too small to result in unbalanced allelic interaction in the diploid pollen. One S-Z pair combination common to pollen and style is sufficient for incompatibility. In comparison to a corresponding one-locus gametophytic system the two-loci system will, thus, effect an increase of general cross-compatibility at the diploid level, but a considerable decrease at the tetraploid level. On the assumption of a wide distribution within the grass family of the two-loci system, the high frequency of polyploidy and of self-incompatible polyploids within the Gramineae constitutes an extremely interesting problem.

LÜTJEHARMS, W. J. University of the Orange Free State. *History of Botany as an Aid to the Philosophy of Science.* Numerous recent publications on the philosophy of science indicate the need for a more synthetic attitude of scientists in a time of inevitable and ever-increasing specialism. In several universities, courses on the history and philosophy of science have been introduced to give future scientists a broader background and a better understanding of their own subject. Many students of science, however, show a profound aversion for technical philosophical terminology which is considered to be too "abstract." A fruitful solution to this problem is a more historical approach in which the elementary principles of epistemology, cosmology, and ontology are explained with the aid of instances from the history of science and, more specifically, of botany. In the author's course the following topics have been treated: (1) epistemology (methodology): progress of science from observation, description, experiment to explanation (causality), generalisation (laws of nature); mathematical expression; (2) cosmology and ontology: nature of the physical world ("Weltbild"), nature of life, understanding of life phenomena, diversity of living beings, their origin, maintenance, and evolution; (3) ethics of science: responsibilities and attitude of scientists toward science (truth), society, and fellowmen. Such a course cannot be given without a definite philosophical standpoint; this should not, however, predominate. A dogmatic approach should be avoided.

LYMAN, HARVARD. *See* SCHIFF, J. A., *et al.*

LYON, CHARLES J. Dartmouth College, New Hampshire. *Clinostat Study of Auxin Transport in Leafy Shoots.* When plants are rotated about their axes, most mature leaves exhibit persistent epinasty, indicating auxin transport principally in dorsal tissues. In nyctinastic species, the leaves assume the night position by day and show a stronger epinasty in darkness because both gravity and light move auxin across their blades. If the rotating plant has actively growing branches, there is usually a strong epinasty of the plagiotropic laterals. If it results in forming an obtuse angle between the axis of the lateral's tip and the axis of the plant, the epinastic curvature is usually soon "corrected" to some extent, often to 90°. This "correction" may be complete to the original plagiotropic angle (*Fuchsia*) or temporarily complete before return to approximately 90°. The mechanism for the induced correctional auxin transport is unknown. If the axis of the rotating plant is growing rapidly, the internodes elongate unevenly, suggesting gravity as a factor in normal auxin transport. The resulting curvatures are usually so coordinated that the axis merely bends to one side, but in the bush bean (*Phaseolus*) the form of the plant is greatly and curiously distorted by uneven effects of auxin from expanding leaves.

LYONS, JAMES M. *See* PRATT, HARLAN K.

LYR, HORST. Institut für Forstbotanik, Eberswalde, Germany. *The Effect of Pentachlorphenol on Metabolism and Enzyme Synthesis of Wood-rotting Fungi.* The effect of pentachlorphenol (PCP) on the metabolism and the enzyme production of some wood-rotting fungi (*Collybia velutipes* Curt., *Trametes versicolor* Pil., *Phellinus igniarius* Quel., and *Fomes marginatus* Gill.) has been studied. A decrease of mycelial dry weight and nitrogen content, an inhibition of the uptake of sugars, an exudation of nitrogen into the culture medium, and a characteristic change of the phosphate-metabolism were caused by the influence of the poison (final concentration, 2×10^{-4} m.). Strong exudation of inorganic phosphate, decrease of high polymer and other high energy phosphates, phosphorylated sugars, and the nucleic acid fraction were interpreted as an inhibition of oxidative phosphorylation. At the same time, the synthesis of the enzyme laccase was induced in *C. velutipes* and *T. versicolor* by PCP. The formation of some other enzymes is inhibited. The effect of PCP was in principle the same on all fungi, but *C. velutipes* proved to be more sensitive than the other fungi under investigation. A higher resistance of the white-rotting fungi in comparison to the brown-rotting one could not be stated. The synthesis of enzymes during the uncoupling of metabolism by PCP is discussed under the aspect of a competition of the enzyme-forming systems during normal growth of the fungi.

MCCLENDON, JOHN H., and JOHN H. KREISHER. University of Delaware. *The Separation on Ion-exchange Celluloses of Fungal Enzymes Hydrolysing Cell-wall Polysaccharides of Higher Plants.* The use of both cationic and anionic celluloses in the batch-wise and chromatographic separations will be described. The action of the separated fractions upon pectate, pectin, galactan, araban, carboxymethyl cellulose, and the maceration of tissue slices will be described with the aim of elucidating the mechanism of the latter.

McClung, Norvel M., and Ichiro Uesaka. University of Georgia. *Variations in Nocardia asteroides Isolates.* In a study of 30 isolates received as *Nocardia asteroides*, four hydrolyzed gelatin, all reduced nitrate to nitrite, none produced indole or hydrogen sulfide, all split urea, used paraffin as a sole carbon source, and produced alkaline reaction in milk. Most isolates peptonized casein, all utilized glucose, none lactose, and all grew on mineral-salts-oxalate medium. Growth, pigment, and aerial mycelium production were influenced by the medium, incubation temperatures, and light. Media composition influenced other environmental effects: for example, on a rich organic medium 17 of 30 strains grew at 45° C., but produced no aerial mycelium. When a mineral-salts-glucose medium was substituted all 30 strains of *N. asteroides* (52) and *N. braziliensis* (12) tested were catalase positive; only eight of the former and four of the latter were positive in the neutral red reaction. Acid-fastness varied with (1) the isolate, (2) cultural age, and (3) composition of media. In 49 of 52 strains of *N. asteroides* acid-fast cells were present at some time during a two-month incubation period. All 12 *N. braziliensis* isolates tested were acid-fast, and one strain of *N. intracellularis* was always avidly acid-fast. When only a few acid-fast cells were present, they were concentrated at the periphery of smears in old cultures but uniformly distributed in young.

McComb, A. L., and F. F. Riecken. University of Arizona and Iowa State College. *Effect of Vegetation on Zonal Soils of Certain Biosequences in the Forest-prairie Region.* The forest-prairie transition region of the central United States provides an opportunity to study on adjacent sites the long-time effect of vegetation on soil formation and soil properties, where the soil-forming factors of parent material, climate, topography, and time are constant. Comparisons within the prairie, prairie-forest (prairie recently occupied by forest), and forest biosequence reveal that soils developed under forest vegetation have least clay in the A horizons, most clay in the B horizons, highest acidity in all horizons, lowest organic matter in A_2 and B horizons and have less permeable, more poorly aerated B horizons. The prairie-forest transition soils are intermediate. Native trees on prairie-forest, compared to forest, soils are 5 to 15 feet taller and produce 25 to 60 per cent more wood per unit area. In central Iowa, prairie-forest transition soils on nearly level glacial till support *Tilia, Fraxinus, Ulmus,* and some *Quercus* species; forest soils support *Quercus alba, Carya ovata,* and *Q. velutina.* In southeastern Iowa, level, loess-derived, transition soils support *Quercus alba, Carya ovata, Q. velutina,* and *Q. rubra* with *Fraxinus* and *Ulmus*; forest soils support *Quercus bicolor, Q. stellata, Q. marilandica, Q. imbricaria,* and *Carya ovata.* Forest occupancy of former prairie soils has resulted in soil deterioration and the ecological succession under a humid-subhumid continental climate has been prairie, mesic forest, zeric forest, as soil changed under influence of forest vegetation.

McConnell, W. B. *See* Nath, R.

McCoy, Elizabeth. *See* Roslycky, E. B., *et al.*

McCune, D. C., and A. W. Galston. Yale University. *On the Relationship of Gibberellin to Peroxidase Activity and Growth.* Many investigations comparing dwarf and normal plants have shown that an inverse correlation exists between peroxidase activity and growth. In the present studies, using the leaf sheath of corn, it was found that the *dwarf-1* mutant has a greater peroxidase activity than the "normal" wild type. Using the internode of peas, it was found that the dwarf variety Progress #9 has a greater peroxidase activity than the tall variety Alaska. The peroxidase activity was determined by the pyrogallol method and based upon the protein nitrogen present. Treatment with gibberellic acid (1 microgram/plant) produces an increase in elongation and decrease in peroxidase activity in the dwarf pea and corn. The differences in both growth and peroxidase activity are seen within 48 hours. By starch-block electrophoresis the peroxidase activity can be separated into different fractions. The changes in the relative amounts of these fractions in relation to maturation and to the changes in activity described above will be considered.

McDonough, E. S., Libero Ajello, Lucille K. Georg, and Sherry A. Brinkman. Marquette University, Wisconsin, and U.S. Public Health Service. *In vitro Effects of Antibiotics on the Yeast Phase of Blastomyces dermatitidis and Other Fungi.* Twenty-two strains of *Blastomyces dermatitidis* showed more sensitivity to cycloheximide at 37° C. than at 25° C. Ten isolates failed to grow at 37° C. on media containing 0.4 mg./ml. cycloheximide while all 22 grew at 0.4 mg./ml. at 25° C. At 37° C. four strains produced growth at 2 mg./ml. while six produced only scant growth at 0.025 mg./ml. and no growth at higher concentrations. The number of cells in the inoculum had an effect on survival. Chloramphenicol had a lesser but similar effect to that of cycloheximide. Varying the constituents of the media other than the antibiotics had no effect on the 25°-37° sensitivity ratio. The use of conidia rather than yeast cells as an inoculum also did not alter the ratio. It has not been possible to demonstrate a definite 25°-37° C. sensitivity differential with the few strains of *Sporotrichum schenckii* and *Paracoccidioides brasiliensis* so far studied. Such a differential does seem to exist for some strains of *Histoplasma capsulatum* but to a lesser degree than for *B. dermatitidis.* (This investigation was supported in part by Research Grant Award E2211 from the National Institute of Allergy and Infectious Diseases, Public Health Service, to Marquette University.)

MacFarlane, Constance I. Nova Scotia Research Foundation. *Ecological Problems Encountered in Surveys of Marine Algae in Nova Scotia.* The coast of Nova Scotia, although confined between latitudes 43°20'N and 47°2.5'N, presents a variety of habitat for marine algae in the littoral and immediate sub-littoral zones. A series of coastal surveys has been undertaken by the Nova Scotia Research Foundation in order to assess the seaweeds of commercial importance. Ecological studies have been initiated in connection with harvesting and regrowth of harvested and denuded areas. Many interesting ecological problems have been encountered. The problems reviewed in this paper concern substratum, character of the coastline, distribution of species, exposure, tidal currents, temperature, salinity, turbidity, and scouring. Geographical variation in density and zonation is described for certain species, as well as the sporadic occurrence of some species and the fluctuating density of others. Problems related to the presence of invertebrates are considered. The species under discussion are chiefly laminarians, fucoids, *Chondrus crispus*, and *Gigartina stellata*, but mention is made also of *Plumaria elegans, Polysiphonia lanosa, Porphyra umbilicalis, Chordaria flagelliformis, Furcellaria fastigiata, Polyides* *rotundus,* and others. The survey methods are discussed and the need stressed for more detailed oceanographic data near the coast.

McGinnis, A. J. *See* Kasting, Robert, *et al.*

McGregor, D. C. Geological Survey of Canada. *Spores and Pollens from Some Mesozoic Deposits of Northern Canada.* Assemblages of spores and pollen grains from several localities within the Canadian Arctic contain types which are similar to species of the Jurassic and Lower Cretaceous of Europe. Preliminary comparisons indicate less resemblance to assemblages of Jurassic-Lower Cretaceous age from southwestern Canada. Two-winged pollen of the coniferous type dominate, and fern spores are prominent components. Angiosperm pollen, if present, is rare. Pollen of Cycadales or Ginkgoales was not found. The assemblages, taken from shales and sandstones, at present represent the only palaeontological evidence for the age of the beds.

McIlrath, W. J. *See* Bell, W. D., *et al.*

McKeen, W. E. University of Western Ontario. *Movement and Encystment of Phytophthora fragariae Zoospores.* As zoospores of *Phytophthora fragariae* move through liquid they rotate and their rigid anterior flagella project directly ahead and neither wave nor bend except during encystment. The rear flagella, which are much longer, apparently propel the zoospores by their waving action. Beads or vesicles of an unknown nature, which are readily observed with the phase microscope, glide down the flagella during encystment. In a short time the flagella are thrown off and their autonomous movement is indicative of their muscular nature. Zoospores of *Phytophthora* species are distinct.

McKell, Cyrus M. *See* Major, Jack

MacLeod, Anna M. Heriot-Watt College, Edinburgh. *Cell Walls of Embryo and Endosperm in the Gramineae.* Water-soluble carbohydrates of cereal "seeds" have previously been shown to be unequally distributed throughout the grain, with the sugars, sucrose and raffinose, predominant in the embryo and the reserve polysaccharide, β-glucan, located principally in the endosperm. Analysis of mechanically fractionated barley now indicates that cellulose and pectic materials are virtually restricted to the embryo and the husk; the cell walls of the endosperm are hemicellulosic and contain no pectic substances. On the other hand, a mannose-containing polysaccharide which can be separated from pearl barley is absent from barley embryos. The composition of the cell walls of the meristematic tissue derived from the zygote is thus very different from that of the endosperm cell walls ultimately derived from the triple fusion nucleus. Although the method of deposition of cell walls in the endosperm is irregular, the reasons for the differences in carbohydrate composition remain obscure. The differences are, however, important in relation to seedling growth, as solubilization of endosperm cell walls is a concomitant of successful utilization of the carbohydrate reserves of the endosperm.

MacLeod, D. M. Insect Pathology Research Institute, Sault Ste. Marie, Ontario. *On the Nutrition of Hirsutella gigantea Petch.* The growth response of

Hirsutella gigantea Petch, a stilbaceous fungus from the order Moniliales, Fungi Imperfecti, was studied in liquid (shaken) cultures after the fungus was isolated in pure culture on Sabouraud maltose agar, from naturally infected spruce budworm larvae (*Choristoneura fumiferana* (Clem)). Approximately 614 mg./50 ml. of fungal mycelium was produced in a simple chemically defined medium with L-glutamic acid as the nitrogen source. This amount is very close to the maximum yield (674 mg.) produced in an enriched medium containing an optimum amount of yeast extract (1.5 per cent). Whereas, however, the simple medium was inoculated with 1.6 mg. of inoculum, only a very small quantity, 0.2 mg., was added to the enriched medium. It was shown that the enhanced growth resulting from the addition of excess inoculum in the synthetic medium was due to accessory growth factors carried over with the mycelial fragments, despite six washings in saline (0.85 per cent NaCl). This carry-over effect, so evident in the synthetic medium, was not detected in media containing yeast extract apparently because of the presence of these growth factor(s) in this substance. In an effort to identify the growth factor(s), various vitamins from the "B complex" group were tested singly and in combination; ashed yeast extract has also been prepared as a convenient method of supplying a mixture of unidentified essential elements, otherwise difficult to assemble. In the enriched (shaken) liquid medium *H. gigantea* grew abundantly as small discs of relatively uniform size (4.3 × 2.3 mm.).

McMEANS, J. L. *See* CARNS, H. R., *et al.*

McMILLAN, CALVIN. University of Texas. *The Role of Ecotypic Variation in the Distribution of the Grasslands of Central North America.* Population samples of grasses were growing in transplant gardens at Lincoln, Nebraska, and Austin, Texas. Twelve species were studied from grassland communities distributed in Saskatchewan and Manitoba southward to New Mexico and Texas. Patterns of ecotypic variation were shown by most of the grass species. Early flowering variants were from northern and western communities and progressively later flowering variants were from the southern and eastern sites. The broad distribution of grassland community types in Central North America involves an intimate relationship between ecotypic variation within the component species and the selective action of the habitat gradients.

McMILLAN, R. Louisiana State University. *Electron Microscopy of Ankistrodesmus braunii.* As reported earlier, *Ankistrodesmus braunii* shows effects of inhibited elongation, inhibited cytokinesis during continuing growth, and failure to maintain intact cell-wall structure, directly correlated, in that order, with increasing concentration of either total solute or certain heterocyclic C-N ring compounds which may function as competitive analogues in nucleic acid synthesis. These findings correlate closely with studies by others of bacteria and yeast-like fungi. Studies were undertaken to ascertain relationship of nuclear events to these phenomena in cells of both normal and experimental cultures. Routine cytochemical procedures, also previously reported, disclosed a picture of normal cells which was difficult to interpret. Only phase microscopy showed structures thought to be nuclei; while nucleus-specific reagents stained variously the pyrenoid and large granules adjacent to it. These granules as well as the cell wall suggested mitochondrial activity. On the basis of these findings, the present electron microscope studies were undertaken to elucidate the nature of intracellular structure. Log-phase cells were fixed in osmium tetroxide for varying periods at varying pH, dehydrated and embedded in methacrylate. The structure of cell components as seen in ultra thin sections of these preparations will be discussed and illustrated.

McMinn, Robert G. Forest Biology Laboratory, British Columbia. *A Study of the Relationship between Pole Height and Rooting Characteristics of Pinus monticola Dougl.* The root systems of thirty-five pole-sized *Pinus monticola* were excavated hydraulically. Analysis revealed that trees showing advanced decline symptoms in their crowns had serious root deterioration, particularly in their absorbing elements. Certain rooting characteristics seem to predispose this species to decline.

McNabb, Harold S., Jr. Iowa State College. *Oak Wilt Disease Research.* The oak wilt disease, caused by *Ceratocystis fagacearum* (Bretz) Hunt, has been found in 18 states east of the Rocky Mountains in the United States of America. The natural host range of the pathogen includes *Quercus* spp. and *Castanea* spp. Research on this disease is coordinated through the Regional Research Cooperative Project Technical Committee, NC-22. Sponsoring agencies include federal, state, and local governments, private corporations, and individuals. Active research centers include state laboratories in Illinois, Indiana, Iowa, Michigan, Minnesota, Missouri, Ohio, Pennsylvania, West Virginia, and Wisconsin. The federal Forest Service maintains research on oak wilt in Missouri, North Carolina, and Ohio. This disease offers research opportunities covering a wide range of basic and applied disciplines in science. Examples include entomology (population, life cycle, disease carrier and nutritional relationships), mycology (growth, reproduction, and nutritional relationships), physiology (biochemistry and biophysics of host-parasite interactions), anatomy (developmental relationships to the pathogen), genetics (inheritance of disease tolerance), and silviculture (control developments).

McNabb, Harold S., Jr., and J. W. Edgren, Iowa State College; and W. E. Eslyn, Albuquerque Forest Insect & Disease Laboratory. *Pathological and Normal Heartwood in Hardwoods.* Observations on the formation of pathological (traumatic) and normal heartwood in *Acer saccharinum, A. saccharum, Quercus alba, Q. velutina, Prunus serotina, Tilia americana,* and *Ulmus americana* indicate similarities. Increment borings made in *A. saccharinum* resulted in streaks of pathological heartwood above and below the bore holes. The same phenomenon was observed for the other species. Other wounding agents, for example, insects, caused the same reaction. The amount produced varied with the tree species, oaks producing the least. Gross observations on the developmental processes of pathological and normal heartwood appeared similar. Field observations on decay zone lines and sap stain fungi indicated that wood-inhabiting organisms reacted similarly to pathological and normal heartwood. Decay resistance of pathological heartwood of *A. saccharinum* to two maple heartrot fungi indicated an intermediate status between normal sapwood and heartwood. Possible seasonal relationships in amount of pathological heartwood formed were indicated for *A. saccharum.* Wound treatments had little influence on pathological heartwood development. Wood-moisture relationships of pathological heartwood, using relative turgidity, paralleled those in normal heartwood formation. Upon aging, pathological heartwood appears to become identical to normal heartwood. This suggests possible means of studying the basic phenomenon of heartwood formation and obtaining heartwood in young trees.

McNULTY, I. B. *See* NEWMAN, DAVID W.

McNULTY, IRVING B. University of Utah. *The Influence of Fluoride on Leaf Respiration.* Although increased leaf respiration due to visible fluoride injury has been recognized, little is known of the effects of sub-lethal concentrations on plant metabolism. This study was designed to discover if respiration, measured as oxygen uptake, was affected by concentrations of fluoride too low to produce visible damage. Bean leaf discs were cultured in nutrient solutions over a light source. Fluoride was added as sodium fluoride of hydrogen fluoride and various buffers were used. Concentrations of 1×10^{-3} to 5×10^{-3} M F^- stimulated oxygen uptake as much as 25 per cent. This is converse to the inhibition that might be expected as fluoride is known to inhibit the enolase reaction. The stimulation was linear with time up to 48 hrs. The respiratory rate of leaf discs removed from fluoride solutions after 24 hrs. and placed on fluoride free media returned to that of the control treatment after several changes of solution. No visible symptoms, such as chlorosis, loss of turgor, or morphological damage, were observed. Higher concentrations of fluoride reduced oxygen uptake long before visible symptoms appeared.

MACNUTT, MARY M. *See* MALTZAHN, K. E. VON

MAGNITSKI, K. P. Academy of Sciences, Moscow. *Diagnosis of Mineral Nutrition of Plants According to Chemical Composition of Leaves.* Chemical analysis of separate parts of leaves (petiole, midrib, laminae) gives necessary information for determining what plants require in fertilizers. The technique of diagnosis includes drawing and preparation of samples from fresh plant material, extraction by acetic acid solution by mechanical blender of tissues, testing of inorganic compositions, and interpretation of results. The test of K, Na, and Ca is carried out by the flaming photometric method, the test of nitrate N, PO_4, Mg, Mn, Al, and Fe by the colorimetric method, and the test of Cl, SO_4 by the nephelometric method. Comparison of the results of chemical analysis of leaves and the productivity of crops when various combinations of fertilizers were applied in long-term experiments gave a chance to determine what the critical levels of content of separate elements in leaves were for achieving rich harvests of potato, sugar beet, and corn. These levels are unequal for various crops and change with the age of plants. Diagnosis of deficiency of nitrogen, potassium, and magnesium, and of excess of chlorine is based on analyses of the petiole of potato leaves and sugar beet leaves, and the midrib of corn leaves. Deficiency of phosphorus in sugar beet is also determined by an analysis of the petiole, but a harmful excess of manganese is easier to discover by an analysis of the laminae in leaves, and a harmful excess of aluminum by an analysis of the roots. The amount of other ions present, owing to the availability of intercommunication, testifies to the disturbance in nutrition of plants. Data on the content of sodium in the leaves are necessary for the evaluation of potassium nutrition in sodium-loving plants. A great difference in the content of separate ions in the leaves of plants under normal and deficient nutrition gave a chance to recommend ways of analysis of sap in petiole or midrib in leaves by dropwise method for five elements. The analysis is simple and is carried out quickly, directly in field conditions by the apparatus: "Magnitski's field laboratory for the analysis of sap in plants." The results of the analysis are used as a basis for recommendations on carrying out top dressing and accurate definition of a system of fertilizers for plants. Such a field control aids a correct application of fertilizers under actual conditions on every farm.

Mahabale, T. S. University of Poona. *Water Ferns, Palms, and Other Monocots from the Deccan Intertrappean Series, India, and Their Resolution into Natural Components.* Of a group of about a dozen fossil palms, all of which were analysed in detail, two of the genus *Palmoxylon* were identified as one belonging to *Phoenix* and one to *Nipa*. Through an anatomical examination of living palm roots, suggestion was derived concerning the classification of the fossil members of the form genus *Rhizo-palmoxylon*. In assigning them to natural genera, the method of diagnosis was based on broad selection of anatomical features in cortex and stele. Vessel specialization as one attribute was found especially useful. Fundamental knowledge facilitating separation and disclosure of affinity among water ferns has also been revealed. Also, for *Azolla*, the geographical distribution has been established for examples ranging from late Cretaceous to the present.

Maheshwari, P. University of Delhi. *Some Examples of the Value of Embryology to Taxonomy.* As Bailey (1949) has said, if a truly natural classification is to be attained, it must be based upon "the analysis and the harmonization of evidence from all organs, tissues and parts." Embryological characters are sometimes of considerable systematic value. As examples may be mentioned: (1) the occurrence of a monosporic 4-nucleate embryo sac in the entire family Onagraceae; (2) the origin of a single pollen grain instead of four pollen grains from a microspore mother cell in the Cyperaceae; (3) the presence of a bisporic embryo sac in the Alismaceae; (4) the lack of an endosperm in the Orchidaceae; and (5) formation of a pseudo-embryo sac in the Podostomaceae. There are no exceptions in any of the five cases cited above. On the basis of embryological characters *Trapa* should be removed from the Onagraceae, and *Butomus* from the Butomaceae. The Lemnaceae are more closely related to the Araceae than to any family in the Helobiales. The recent proposal for removing *Sphenoclea* from the Campanulales and assigning it to a new position between the Phytolaccaceae and Primuleae is not sound. While the embryologist lays no claim to erect a phylogenetic system of his own, embryological data need to be considered along with others in order to formulate a really natural system of classification.

Maheshwari, Satish C. University of Delhi. *Systematic Position of the Family Lemnaceae.* The systematic position of the family Lemnaceae has always been a subject of discord. While most botanists have accepted Engler's view that the duckweeds are allied to the aroids and arose as a result of retrogressive evolution (somewhat in the sequence, *Pistia–Spirodela–Lemna–Wolffia*), there are others who have derived the duckweeds from the Helobiales. Recently the latter view has been revived in considerable detail (Lawalrée, 1943, 1952). I have tried to reassess the problem from the embryological evidence. The studies conducted reveal great resemblances between the aroids and the duckweeds, such as the monosporic character of embryo sac (in *Lemna* and *Wolffia* the embryo sacs are bisporic), cellular endosperm, presence of a typical endosperm caecum, and a strikingly similar embryogeny. The embryology of *Spirodela* is particularly illuminating. In most characters, *Spirodela* is certainly like the other duckweeds, but interestingly enough, in regard to its monosporic embryo sac and very well-developed basal apparatus, it reminds one more of the aroids than its own sister genera. On embryological grounds at least there is no case for considering the duckweeds as related to the Helobiales. On the contrary, Engler's view appears to be sound, not only generally, but even in respect of the detail of the evolutionary sequence suggested by him.

MAHLBERG, PAUL. University of Pittsburgh. *Origin and Development of the Laticifer in the Embryo of Nerium oleander L.* The non-articulated laticifers, which form a conspicuous tissue system in the growing plant of *Nerium oleander* L. (Apocynaceae), are differentiated during the initial delimitation of the primary meristematic tissues in the developing globular embryo. Laticifer initials, which become evident during initiation of the cotyledonary primordia, arise from meristematic cells which in their position constitute elements of the embryonic procambium tissue. A total of twenty-eight laticifer initials arise as an irregular ring of cells directly below the embryonic shoot apex and to the inside of the embryonic cortical tissue. During subsequent embryo development the laticifer initials grow in a bidirectional manner intrusively penetrating downwardly into the embryonic root system and upwardly into the embryonic shoot system. Mitosis in the initials results in the formation of a coenocytic protoplast. A plexus of branches derived from the initials and their many bifurcations is formed at the cotyledonary node of the mature embryo. Laticifer branches from the cotyledonary nodal plexus penetrate into the growing shoot system and root system, permeating the entire plant body.

MAINI, J. S. *See* COUPLAND, R. T.

MAISSOURIAN, N. A. Académie Lenine des Sciences Agricoles de l'URSS, Moscou. *Histoire de la Culture du Lupin.* Dans sa croissance naturelle, le lupin est très connu dans les deux hémisphères. Dans les régions méditerranéennes on trouve 9 variétés de cette plante, pourtant une seule, le *Lupinus albus* L., fut admise, il y a plus de 4,000 ans, comme culture agricole. En Amérique on en trouve quelques centaines d'espèces. Pourtant, même ici un vieux Péruvien n'en a pu créer qu'une seule, le *L' mutabilis* Sweet, qui fut cultivée pendant plus de 10,000 ans. Les divers lupins sauvages des régions méditerranéennes et les variétés d'Amérique se distinguent surtout par leur caractères botaniques. Malgré sa matière première tout à fait differente, le choix inconscient des agriculteurs de l'antiquité, fait pendant des milliers d'années dans les régions les plus éloignées et les plus indépendantes du globe terrestre, a pu créer deux espèces cultivées et conformes, ayant les mêmes caractères botaniques et économiques. Ces deux variétés, les plus anciennes qu'on connaisse, sont caractérisées par leur grande hauteur, le type sympodial supérieur des branches de la tige principale; des fèves qui ne se fendent pas; de grosses graines de semence blanches; la pelure fine des graines; leur gonflement rapide et simultané, ainsi que par la grande quantité non seulement de proteine, mais aussi de matières grasses. Ces deux espèces de lupin, pouvant être cultivées, sont très éloignées du lupin sauvage, grâce à leur caractères si différents. C'est de cette façon que les agriculteurs de divers pays travaillaient à l'unisson dans l'antiquité, pour créer différentes espèces du lupin cultivable. Il y a environ centains; on mentionne en Europe deux nouvelles espèces de lupin: *L. luteus* et *L. angustifolius.* Il sera intéressant de noter que la culture de ces deux variétés, en adaptant les méthodes de la sélection scientifique préméditée, en connaissance de cause, suit généralement le même chemin. Les variétés actuelles des différentes espèces de lupin se rapprochent de plus en plus par leur caractères du lupin cultivé de l'antiquité. Toutes ces données indiquent l'intérêt que présente en ce moment, au point de vue théorique, l'histoire des différentes espèces de lupin, pouvant être cultivées.

MAJOR, JACK, and CYRUS M. MCKELL. University of California. *The Autecology of Medusa Head (Elymus caput-medusae* L.). Medusa head is an unpalatable annual grass which has invaded rangelands of the Pacific Coast states and Idaho. In the Old World the weed grows bordering the Mediterranean and east to Tadzhikstan. Knowledge of this plant's autecology is being used in a program of range improvement designed to replace the weed by better forage plants. Medusa head occurs in climates with from 60 to 11 inches (1,500 to 280 mm.) of precipitation per year, torrid summers, and winter frost. The rain comes in winter, and soil water is abruptly used up in late spring. Soils are deep, high in clay content of expanding lattice type, and so retain more available soil water later in spring than do the zonal soils. Soils vary from non-calcic brown through chernozems to clayey sierozens. Data obtained on seed production and dissemination, germination requirements, emergence, phenology, heat and moisture requirements, and competitive ability contribute to an understanding of the weed's life history. These data suggest experimental manipulation of medusa head dominated vegetation by seeding adapted annual legumes and perennial grasses, fertilization, tillage, fire, and herbicides to replace this undesirable range invader by better forage plants.

MALAVOLTA, E. "Luiz de Queiroz," São Paulo, Brazil. *Foliar Diagnosis in Brazil.* The work on foliar diagnosis now under way in Brazil is aimed at determining the point or rather the level beyond which the use of fertilizers is no longer economical. The problem is being worked out in the following manner: a large number of factorial experiments have been set up; with the use of specially developed mathematical equations the most economical doses of a given fertilizer are ascertained; the critical levels are then calculated either by interpolation or by extrapolation. For young, bearing coffee trees it was found that yields would drop only when the nitrogen level fell below 2.8 to 3.0 per cent, the decrease being accompanied by a reduction of K content below 1.6 to 2.0 per cent; available data for phosphorus are not conclusive: the evidence, however, suggests 0.25 to 0.30 per cent as safe limits. For corn just a few data have been gathered so far. They suggest that sampling should be done at tasseling stage, the sixth leaf from bottom being taken for analysis. The level of nutrients oscillates around the following values: 3.0–3.5 per cent N, 2.5–3.0 per cent K, and 0.20–0.25 per cent P. In the cotton plant best correlations between chemical analysis and yield were found when leaf samples were collected halfway up the stem, from fruit-bearing branches when the flowers had just begun to show. The following levels seem to be satisfactory: 3.5–4.0 per cent for N, 1.25–1.30 for potassium. For sugar cane, nitrogen level should be between 1.5 and

2.0 per cent; adequate levels of phosphorus are between 0.25 and 0.30 per cent; potassium is sufficient when the leaf content varies in the limits 1.5 and 2.0 per cent. These values refer to the medium portions of third and fourth leaves, the midrib being discarded, collected when plants are six to nine months old.

MALDONADO-KOERDELL, M. Mexico City. *Bark Fragment from the Continental Slope off the Guatemala Coast.* In the course of dredging operations on the continental slope, opposite the mouth of Río Suchiate off the Guatemala coast, at a depth of 400 fathoms, a fragment of semi-fossilized bark of an arboreal plant was collected in November 1958. The fragment is in a highly advanced stage of silicification, which probably had been initiated on the continent sometime before the fragment was dragged into the sea. Its anatomical structure is well preserved on the external side, but much less so on the internal side, and a xylological study is now in progress, which will probably lead to a more satisfactory taxonomic identification of the fragment.

MALTZAHN, K. E. VON, and MARY M. MACNUTT. Dalhousie University, Halifax. *Some Observations on Cellular Dedifferentiation in Splachnum ampullaceum [L.] Hedw.* It has been shown for the present material that isolation and not wounding is the important factor in the removal of correlations which inhibit the realization of regenerative potentialities in the whole gametophore. As a result of isolation, therefore, mature differentiated cells may return to the embryonic state before they redifferentiate. The process of cellular dedifferentiation involves profound changes. Some of these have been studied, especially with reference to leaf cells. The behaviour of cells of an attached, wounded half-leaf is compared with that of cells of an isolated, wounded half-leaf. Cells of young leaves are also compared with those of older leaves treated in the same way. Early increases in the number of chloroplasts per cell with a corresponding decrease in their size, and increases in nuclear size are observed only in cells of the isolated half-leaf. This is followed by protoplasmic strand formation leading to systrophe. Differences in cells of young and older isolated half-leaves are described. Phenomena of systrophe are considered as an important step in normal dedifferentiation. Some factors affecting systrophe and redifferentiation are discussed.

MANIGAULT, P., P. SCHAEFFER, et CH. STOLL. Institut Pasteur de Paris et Institut de Botanique Spéciale de l'E.P.F. de Zürich. *Etude du principe inducteur des tumeurs végétales* (*crown gall*). Braun et d'autres auteurs ont introduits la notion d'étapes successives dans le mécanisme de la transformation tumorale: (1) phase de conditionnement de la plante lié au phénomène de blessure et indépendant de la bactérie Agrobacterium tumefaciens (Smith et Townsend); (2) phase d'induction, caractérisée par l'élaboration d'un principe inducteur en présence de la bactérie compétente; (3) phase de prolifération indéfinie de la tumeur. Nous avons centré notre travail sur la séparation et la définition d'une ou de plusieurs substances capables d'induire la tumeur au même titre que le germe entier. Ces substances ont été isolées à partir de cultures de bactéries *in vitro* et ont été expérimentées dans des conditions de stricte stérilité sur des plantes entières et sur les cultures de tissus végétaux. La discussion de ces résultats fait apparaître le rôle des acides nucléiques dans l'élaboration du principe inducteur.

Manigault, Pierre. Institut Pasteur de Paris. *The Crown-gall Disease.* Le problème de la cancérogénèse est un problème de croissance (Braun, 1958). A ce titre les tumeurs du crown-gall offrent un matériel expérimental particulièrement favorable à l'étude du mécanisme de la transformation d'une cellule saine en cellule tumorale car l'authenticité du cancer des plantes n'est plus discuté. (1) Dans une première étape de durée limitée, le "conditionnement" rend les cellules végétales normales susceptibles d'être transformées en cellules tumorales. L'aspect histologique, cytologique, et physiologique des phénomènes de cicatrisation a été décrit, et des recherches récentes poursuivies *in vitro* tendent à préciser les fractions actives de jus de presse provenant de plantes blessées. (2) Dans ce climat physiologique particulier, lié aux traumatismes la bactérie compétente intervient au cours de la seconde phase de la transformation, l' "induction," qui se situe dans le temps plusieurs heures après la blessure et se termine au moment où les divisions cellulaires commencent et assure alors la prolifération indéfinie de la tumeur. L'étude de l'élaboration d'un principe inducteur de la tumeur est en cours, il sera discuté point par point des résultats connus quant à son origine. Le taux anormal de substance de croissance apparaît comme responsable des caractéristiques du tissu tumoral. Le P.I.T. détruit-il un inhibiteur de croissance efficace dans les tissus sains?

Mankowski, Z. Thaddeus. Institute for Cancer Research, Philadelphia. *Pathological Changes Observed during Experimental Chronic Candidiasis.* Pathological changes in the course of experimental infection with *Candida albicans* (isolated from a case of Hodgkin disease) in CFW mice were most frequently observed in kidneys. Predominantly purulent infiltration along the pelvis of the kidney and parenchymatous inflammation of this organ were observed. Less frequently, granulomatous lesions were seen. Frequency of amyloid deposits has been previously presented (Int. Congr. Trop. Med., Lisbon, 1958). Cystic changes resembling "cystic disease" described by Gorer or "papilonephritis" by Dunn were frequently seen. Probably they form as a sequel of papillary obstruction. In some cases, massive invasion of adrenals and their destruction was seen. Periarteritis of the renal vessels was frequently seen, occasionally pericholangitis. Degenerative changes with distortion of the liver cells, occasionally resembling hepatoma, and a case with inclusion bodies were seen. Out of fifteen C57 mice infected, one showed a hepatoma resembling picture. Among six infected rats, there was one case of lymphatic thymic tumor and one of sarcoma. Mice infected with 1:2,000 volumetric suspension in 5 per cent mucin produced disseminated miliary changes. Infection fourteen days after the first one produced disseminated necrotic changes in various organs, especially the liver. During the infection, when the organisms could not be visualised by McManus technique, frequently their disintegrated forms could be seen in Rabinow staining.

Manton, Irene. University of Leeds. *Chromosomes and Phylogeny in the Pteridophyta.* This paper will survey the progress made since the publication of my book in 1950 (*Problems of Cytology and Evolution in the Pteridophyta*). There have been two main lines of enquiry, namely, intensive studies of wide-ranging species complexes by the usual methods of controlled breeding followed by chromosome analysis, and extensive studies of very numerous species and genera mainly from tropical floras in order to permit the cytological characterization of families. Species complexes studied include *Polypodium vulgare, Asple-*

nium trichomanes, Asplenium adiantum nigrum, Dryopteris spinulosa, and *Cyclosorus parasiticus,* the last being tropical and the others temperate. New insight into the interrelationships of floras as well as component species has resulted. At the generic level extensive sampling of the fern floras of Ceylon, Malaya, Africa, Jamaica, and to a lesser extent India, New Zealand, and North America has given cytological information on over a hundred genera of ferns which is sufficient to determine the cytological characteristics of the main modern fern families and some of the older ones. A few major changes in accepted taxonomic usage have been suggested which carry phyletic implications.

MANTON, IRENE. University of Leeds. *The Fine Structure of Plant Cytoplasm at Various Stages in an Active Meristem.* One of the first results of recent work on the electron microscopy of plant cells has been to show the extraordinary similarity in major cell components among all the main groups of land plants, in contrast to the range of diversity encountered among algae. For this reason, it is not inappropriate to use a primitive livewort to illustrate some of the topics relevant to this symposium and most of the time will be spent on the meristem of *Anthoceros*. The paper will survey salient features of fine structure of protoplasmic organs at various degrees of vacuolation of a cell and at various stages of the mitotic cycle. It will be illustrated by electron micrographs.

MANTON, IRENE. University of Leeds. *Plant Ciliated Cells.* The paper will consist of a comparative survey of salient features of morphology and microanatomy of plant motile cells (unicells, zoospores, and gametes) in a number of major groups including Chrysophyceae, Chlorophyceae, Xanthophyceae, Phaeophyceae, Bryophyta, and Pteridophyta. Electron microscopy has now reached the stage at which details of structure of cytoplasmic organelles such as mitochondria, golgi, and flagellar roots in addition to plastids can be effectively used for classificatory purposes. The correlation of structure with function is less far advanced, but studies of development are yielding surprising insight into the physical properties of certain cell components. The paper will be copiously illustrated with electron micrographs.

MARAMOROSCH, KARL. The Rockefeller Institute, New York. *Leafhopper-transmitted Plant Viruses.* Leafhopper-transmitted plant pathogenic viruses with dual hosts — a plant and an invertebrate animal — are being studied in several laboratories. Virus purification by density gradient centrifugation (M. K. Brakke) made possible electron micrographs and serological tests. The latter revealed a "subvirus" that precedes the formation of infective virus during incubation (L. M. Black). Studies with fluorescent antibodies are now conducted to detect insect tissues in which viruses multiply (L. M. Black). Cytopathogenic changes discovered in fat-body cells revealed a chronic disease of a vector (V. C. Littau and K. Maramorosch). Shortened longevity has been reported for leafhoppers infected by a plant virus (D. D. Jensen). Cross-immunity between virus strains in vectors has been discovered for two strains of aster yellows (L. O. Kunkel). Interrelationships of three strains of this virus in its vector have been investigated (J. H. Freitag). Unilateral protection by strains of corn-stunt virus in a vector, and a beneficial effect of a virus on a non-vector leafhopper have been found (K. Maramorosch). Virus multiplication has been studied not only in intact leafhoppers but also in *in vitro* insect tissues, and more recently in dissociated plant cells. It is hoped that investigations on a cellular level will lead to a better understanding of host-virus interrelationships.

MARCUS, ABRAHAM. Agricultural Marketing Service, Beltsville, Maryland. *Photocontrol of the Formation of TPN Triosephosphate Dehydrogenase.* Glyceraldehyde-3-phosphate may be enzymatically oxidized through several pathways. One of these requires triphosphopyridinenucleotide (TPN) and results in the formation of diphosphoglyceric acid. This reaction has been shown to occur only in leaves of plants grown in the light. Since such leaves may be differentiated from those grown in the dark by the presence of chlorophyll, the participation of this enzyme (TPN triosephosphate dehydrogenase) in photosynthesis was suggested. Since many biological phenomena have been found to be controlled by red and far-red radiation, it was considered worthwhile to investigate whether TPN triosephosphate dehydrogenase might be similarly controlled. Employing red kidney beans, we have found that leaves of plants grown with brief red radiation contain the enzyme although essentially no chlorophyll is formed. Far-red radiation reverses the promotive action of the red radiation. Evidence will also be presented showing that the reduction of TPN is not due to transhydrogenase or other possible side reactions.

MARFEY, CHARLOTTE, and RUTH SAGER. Columbia University. *Transmission of Parental Proteins and Nucleic Acids to Progeny in Chlamydomonas.* The non-chromosomal inheritance of streptomycin resistance in *Chlamydomonas reinhardi,* an isogamous, unicellular alga, has been reported by Sager (Proc. Nat. Acad. Sci., 1954). Since this factor is transmitted exclusively through the plus mating type, in a manner analogous to maternal inheritance, one may inquire whether all or some of the cytoplasmic components contributed to the zygote by the minus parent share the same fate as those contributed by the plus. The plan of this investigation was to follow radioactive proteins and nucleic acids derived from each parent throughout the maturation and germination of the zygote. Parental strains were grown in S^{35} sulfate to label the protein fraction, and in other experiments in C^{14} orotic acid, a pyrimidine precursor which goes mainly into RNA. The level of radioactivity was measured in zygotes obtained after reciprocal matings between labeled and unlabeled parents. The radioactivity in the protein fraction has been found to remain fairly constant during maturation and germination, and no significant differences have been found between zygotes of reciprocal crosses.

MARGULIES, MAURICE. *See* JAGENDORF, ANDRE T.

MARIAT, FRANÇOIS. Institut Pasteur, Paris. *Dimorphisme in vitro de Sporotrichum schenckii: Caractéristiques biochimiques des phases levure et mycélienne.* *Sporotrichum schenckii,* champignon pathogène dimorphique, peut être obtenu en culture sous sa phase levure parasitaire comme sous sa forme mycélienne saprophytique dans un milieu simple chimiquement défini. On étudie de façon critique les divers facteurs qui influent sur la transformation mycélienne-levure *in vitro* chez *S. schenckii.* On insiste sur le rôle de l'anhydride carbonique, facteur déterminant et l'on montre que le CO_2 est facteur de croissance pour *S. schenckii.* La composition de chacune des phases en acides désoxyribonucléique et ribonucléique au cours de la croissance du champignon permet de tirer certaines conclusions sur le dimorphisme qui le caractérise.

Marrè, E. University of Milan. *Mechanisms of Control of Respiration in Higher Plants.* Respiratory metabolism is considered from the following standpoints: (*a*) the synthesis of high energy bonds available for metabolic work; (*b*) the formation of materials apt to be utilized for anabolism; (*c*) the formation and maintenance of a reservoir of reducing power at a high redox potential, to be used for the control of the state of oxidation/reduction of active components of the plasma. Some results are presented showing that in pea-stem tissues the following factors are simultaneously involved in the control of respiration: (1) the concentration of phosphate acceptors and the value of the adenosine triphosphate/adenosine diphosphate ratio; (2) the concentration of substrates at different levels of the respiratory net-work; (3) the effective activity of oxidative enzyme systems, with particular regard to dehydrogenases and terminal oxidases; (4) the oxidation/reduction state of systems capable of influencing enzymatic activities, such as the glutathione and the ascorbic acid systems. As an example of physiological control of respiration, the effects of auxins on the oxidative metabolism of pea-stem tissues are analysed.

Martens, Pierre-Edouard. Université de Louvain, Belgique. *Structure et ontogénèse de la fleur ♀ de Welwitschia mirabilis: Comparaison avec d'autres Gnétales.* L'ontogénèse florale ♀ de *Welwitschia*, minutieusement suivie, montre que la fleur comporte normalement un verticille externe latéral, extérieur à l'aile de la graine, et qui est seul homologue du verticille externe de la fleur mâle. Mais l'évolution l'a souvent réduit à des vestiges, que révèlent les sections microtomiques. Un sillon latéral délimite ensuite, dans l'aile future, deux lobes, dorsal et ventral, mais dont le plan de partage s'effacera par croissance ultérieure. Toute cette ontogénèse contredit formellement celle décrite par Hagerup. L'origine du tégument, vérifiée aussi chez Gnetum, empêche de l'homologuer à une sporophylle. Les sept diagrammes publiés sont incorrects et le seul valable sera présenté. La connaissance du contenu global du cône montre les organes axillaires, suivis de haut en bas, y délimitent une courbe à deux maxima et deux minima: fleurs de taille croissante, fleurs de taille décroissante, ébauches florales rudimentaires au point d'être équivoques, ébauches strobilaires rudimentaires au point d'être équivoques, strobiles avortés plus développés. Le fonctionnement de l'apex du cône, dans le temps, a été reconstitué et l'inhibition de croissance qui justifie cette série est la plus accusée au niveau de transition entre fleurs et strobiles.

Martin, Louis B. Los Angeles State and County Arboretum. *Educational Programs in Arboretums and Botanic Gardens.* To balance today's accelerated pursuit of the physical sciences, community arboretums and botanic gardens can offer avocational opportunities through lay education in horticulture and nature study. Education is defined to include the curious visitor and the dedicated student. This educational program should seek children as well as adults. Program objectives must serve the local geographical area and be clearly defined in the general policy of the institution. For children, course work should supplement classroom experience. For adults, problem-solving keynotes the planning of courses. Quality of instruction must be high, with expert instructors and stepwise development of numbers and kinds of subjects, based on community demands. Direction of the program should be under one individual; however, all facilities and staff must be ready for use in the program. A "professional" school can be the ultimate goal in such an educational program. Apprentice training in the fundamentals and practice of horticulture and botany can raise the standards generally of home, governmental, and commercial horticultural endeavors. Some rewards of such a program are: valuable avocations, improved property values, commercial increase for nursery business, civic pride in cultural achievements, early capture of children's interest in nature.

MARTINSON, CHARLIE. *See* BAKER, RALPH

MARVIN, JAMES W. University of Vermont. *Mechanism of Sap Flow.* Plant physiologists have, for many years, been aware of a pressure-producing system in the dormant stems of species of *Acer* and some other genera. The pressures occur in leafless plants whose twigs and stems constitute a closed system. There is little water loss from the buds in the winter, and the water content of the tissues is higher than it is in summer. The transitory xylem pressure is induced by a warm temperature following a freeze. Investigators have attributed the pressures to gas expansion in the warmed stems, to the volume change due to the change in state from ice to water, to osmotic phenomena, and to root pressure. Recent experiments have contributed new information about the maple sap flow mechanism and the more general problem of the movement of water in dormant stems. The maple sap flow mechanism is dependent upon cycling temperatures above and below 0°C. During the cooling part of the cycle, sap is absorbed by the tissues of the stem from the roots. The volume of the flow following warming is quantitatively related to the cooling part of the cycle, not to the warming part. Theories to explain the mechanism based on temperature effects on physical systems appear inadequate. Living cells are necessary. The solute content of the vessel sap is important but a simple osmotic explanation is inadequate. A rapid temperature-induced change in the water content of some xylem cell walls is a complicating factor.

MASON, HERBERT L. University of California. *Formal Instruments of the Taxonomic System.* Classes, categories, and taxa are formal taxonomic instruments, which help express order and connexion within the manifold of organisms. These instruments are definable universally only in the language of formal relations and not by the properties of organisms. In systems based on relative similarity of organisms, taxonomic classes are the logical extension of those sets of properties expressing the similarity of their members. Here no particular properties are designated nor any particular members denoted. Thus, properties express only relations of similarity between members, which relations are the essence of such classes. *Taxon* is a category of formal properties of the class which express the connected relation of the class with its terms. By means of the properties of the included defining types which are in ordered, one-to-one correspondence, "taxon" expresses the class unity, identity, and level; it is therefore a cardinal notion. *Taxonomic categories* are ordinal notions expressing serial relations of predecessor and successor classes. The relations are both "is included in" and "includes," which through a formal operation become "follows" and "precedes," thus giving rise to the notion of betweenness. "Species" comes then to mean the position of the class between its membership and its generic class.

MATHIAS, MILDRED, and LINCOLN CONSTANCE, University of California; and REINO ALAVA, University of Turku, Finland. *Illustrations of South American Umbelliferae.* Morphological differentiation in South American Umbelliferae has resulted in a number of unique vegetative forms ranging from the almost leafless intricately branched speciose shrub of the desert to the woody cushion form of the Alpine areas. The taxonomic study of these genera has been greatly facilitated by the critical illustrations of the junior author.

MATHON, CLAUDE-CHARLES. Université de Poitiers, France. *Infrarouge et spectrostade.* Chez les Graminées annuelles de jour long, lorsque la température et la photopériode quotidienne sont favorables, le développement est fourni (à 0,70 m. du sol) par des tubes fluorescents du type "lumière du jour de luxe" (4 × 40W/I m.^{2}/) simultanément avec des ampoules à incandescence (4 × 100W/I m.^{2}/), à maximum vers 10-11.000 Å, que lorsqu'il est fourni seulement par des tubes fluorescents (8 × 40W/I m.^{2}/), l'énergie émise, dans le visible, étant très voisine dans les deux variantes (E. Fustec-Mathon et Cl.-Ch. Mathon, Bull. Soc. bot. France, 1958, *105:* 219, 323). Nos expériences confirment l'existence d'un 3ème stade du développement (spectrostade) (M. Stroun, Physiol. plant., 1958, *2:* 548), succédant au photostade *sensu stricto.* Il se situe par l'apparition des bosses d'épillets et leur différenciation précédant la formation des bosses d'étamines. L'infrarouge relativement proche joue à ce stade un rôle déterminant révélé par l'étude sous des photopériodes quotidiennes pénéliminaires.

MATTHEWS, J. D. British Forestry Commission. *The Flowering of Some Clones of Beech (Fagus sylvatica, L.).* In Britain beech does not normally flower until 20 to 30 years from seed. Flowering is also markedly periodic. The flowering of thirteen clones of beech (produced by grafting scions from adult trees on to juvenile rootstocks) has been observed to (*a*) determine their flowering behaviour; (*b*) devise methods to bring beech grafts into flower quickly; (*c*) establish seed orchards. There is great variation between clones both in time of first flowering and in the quantity of male and female flowers produced. One clone flowered in the third season after grafting; four have flowered from the fourth season; three have not yet flowered eight seasons after grafting. One clone of nine plants produced over 1,500 female flowers in 1958. Many flowers of both sexes are borne on "short shoots" situated in the lower and middle parts of the crown. The flowering of most grafts has tended to be biennial; one graft has produced a few flowers each year since 1954. Partial stem girdling applied in May 1957 resulted, with some exceptions, in increased production of flowers in 1958. Some proposals for establishing seed orchards of beech are derived from these studies. The importance of co-operation between tree physiologists and tree breeders is emphasised.

MATTICK, FRITZ. Botanisches Museum, Berlin. *History and Literature of Lichenology.* The author has been working for some time on a book about the history and literature of lichenology which will be the continuation of the corresponding work (3 volumes) by Krempelhuber. In the first part of the book the historical development of lichenology from 1870 until today will be dealt with. The second part will contain a short biography of each lichenologist in alphabetical order, and the present conservation places of their collections will be mentioned. Each biography will be followed by a list of all publications by the respective lichenologist. As many portraits of the scientists as possible will be included. In the third part, the lichenological literature will be arranged according to special fields, for example, taxonomy, systematics, morphology, anatomy, chemistry, biology and ecology, geography and floristics (arranged according to countries), application of lichens in practice, etc. The fourth part will give detailed information about lichen collections in the major botanical museums, institutes, and research centres in the various countries. The author kindly asks all lichenologists to lend their support by sending him a short biography, a photograph (passport size), a list of their publications, and separate prints of these.

MAYCOCK, PAUL F., and J. T. CURTIS. McGill University and University of Wisconsin. *The Boreal Coniferous-deciduous Forests of the Great Lakes Region of North America.* In the northern Great Lakes region the boreal coniferous forest becomes confluent with the southern deciduous forest. These intermingling tendencies have given rise to forest communities of an intermediate nature, a situation which is further complicated by the presence of important dominants with distributions more or less centered in the area. Quantitative data on forest composition were collected throughout the area from Minnesota to Ontario, for 110 undisturbed stands in which white spruce (*Picea glauca*) was present. These data were examined in relation to an ordination of stands on the basis of moisture conditions of site and subsequently in relation to a three-dimensional phytosociological gradient. The relations of a predominant number of species to both of these treatments emphasize the continuous nature of these forest communities. The solution of problems in this complex ecological situation should assist in further interpreting relations in the adjacent boreal and deciduous forests.

MAYER, A. M. Low Temperature Research Station, Cambridge, England. *Glycolytic Phosphorylation in Peas.* The cotyledons of peas germinated up to three days contain a system which takes up phosphate in the presence of hexose diphosphate and acetaldehyde and which results in ATP formation. This system is contained in the soluble fraction of extracts, that is, it is not precipitated at 20,000 gm. This enzymic system does not appear to be affected by coumarin. It is, however, inhibited by pentanol and stimulated by thiourea. It is possible to demonstrate glycolytic phosphorylation in extracts of entire seedlings. This is apparently due to the presence of some enzymes in the embryonic tissue of the germinated peas, which interfere in the phosphorolytic processes.

MAYNE, BERGER C., RUFUS LUMRY, and JOHN D. SPIKES. University of Minnesota and University of Utah. *The Fluorescence of Chloroplast Fragments in Relation to the Kinetics of the Hill Reaction.* Relative fluorescence yields and Hill-reaction rates of chloroplast fragments have been measured as functions of light intensity, temperature, and oxidant concentration. Results of these experiments indicate a simple relation between fluorescence yield and the Hill reaction. The fluorescence *versus* light intensity curve may be fitted with an equation of the following form: $O=k_f\ (1-A/I+B)$, in which O is the relative fluorescence yield, k_f, A and B are constants, and I is the light intensity. A and B can be related to the Hill-reaction rate constants. The fluorescence of chloroplasts during the course of the Hill reaction undergoes a slow increase until the oxidant, as indicated from parallel Hill-reaction rate measurements, was reduced.

At that time there was a rapid increase in fluorescence. The relation between the fluorescence yield and the Hill reaction may be interpreted on the basis of a statistical photosynthetic unit consisting of a collection of chlorophyll molecules which transfer their energy by resonance migration to a trapping center at which the migrating quanta are trapped and made available for chemical processes. The implications of this for the efficiency of photosynthesis will be discussed.

MEDVEDEVA, G. B. Academy of Sciences, Moscow. *Role of Supplementary Pollen Tubes in Dominance Transformation in Wheat.* There are two aspects of the sexual process in higher plants: (1) the fusion of male and female gametes, resulting in zygote formation; (2) purely metabolic influence on the zygote and the developing embryo of pollen tubes, not participating in gamete conjugation, but entering the ovary and being consumed by the embryo in its development. When the pollen of only one variety is used for pollination, both aspects of the sexual process are indistinguishable. In order to separate the action of one from that of the other, a method of pollination with the pollen of two different varieties was used. In such a case one pollinator variety gives its spermatozoid to fuse with the egg cell and so becomes the male parent. The pollen tubes of the second pollinator influence the heredity of the embryo only by means of assimilation without participating in gamete conjugation. Their action is analogous to that of grafting hybridization. In several series of crosses between wheat varieties, each cross combination was composed in such a way that each of the two pollinators possessed at least one dominant character which was not present in the other pollinator and in the mother variety. Inheritance analysis of variety characters (spike colour, awness, downiness, grain colour) showed that normal dominance conditions in such crosses were strongly disturbed. This resulted in: possible appearance (1) in F_1 and F_2 of plants possessing dominant characters of both pollinator varieties, (2) of plants with dominant characters in the F_2 and F_3 progeny of plants with corresponding recessives.

MEDWECKA-KORNAS, ANNA. Botanical Institute, University of Kraków. *Some Problems of Forest Climaxes in Poland.* The climax of the highest forest zone in the Western Carpathians consists of acidophilous association *Piceetum tatricum.* It has been assumed hitherto that the climax of the lower zone is the eutrophic forest *Fagetum carpaticum,* though in fact it may be an acidophilous beech forest with an oligotrophic herb layer. In the Polish lowland the mixed forest *Pineto-Quercetum* fits best the requirements postulated for climax associations. Nevertheless, in many areas *Querceto-Carpinetum* dominates on rich soils and *Pineto-Vaccinietum myrtilli* on poor sandy soils. It is easier to define climaxes in extreme climatic conditions and also when a dominating plant association is not in opposition to the natural soil processes. In some cases, however, the definition of a monoclimax is highly hypothetical and it is easier to define the climax groups. There is no need to discard the hypothetical possibility that the associations of a climax group (with the exception of paraclimaxes) can develop towards a monoclimax. The use of the climax concept as the basis for the classification of forest associations seems impracticable. For classification purposes the most useful criteria are floristic.

MEES, G. C., and P. E. WEATHERLEY. Imperial Chemical Industries Ltd., Jealott's Hill Research Station, Bracknell, Berks., and the University of Nottingham. *The Mechanism of Water Movement through Plant Roots.* An apparatus is described in which the water flux across the cortex of a detopped tomato-root system in response to osmotic and hydrostatic pressure gradients was measured. With a pressure on the medium surrounding the roots, two estimates of the cortical permeability were made: (1) The water flux per unit pressure difference between medium and xylem, called the pressure permeability coefficient k_P. (2) The flux per unit osmotic potential difference, called the osmotic permeability coefficient k_o. The application of pressures to the medium had two effects on water movement. It was found that k_o increased when the pressure was raised, indicating that diffusion of water across the cortex was facilitated. At a fixed pressure the ratio k_P/k_o was consistently greater than one, showing that in addition to facilitating diffusion a pressure gradient caused a mass flow of water. This amounted to a quarter the total flux with a 2 Atm pressure difference. It is suggested that pressure gradients cause changes in cortical permeability similar to the changes induced by tensions in the transpiring plant, and that the method can be used to study the uptake of solutes as well as water.

MEEUSE, BASTIAAN J. D. University of Washington, Seattle. *Oxalic Acid Oxidase in Mosses and Higher Plants.* Oxalic acid oxidase (OA-ox.), which has now been demonstrated in beet roots and seedlings as well as in the leaves of Chenopodiaceae and mosses, must be considered a mitochondrial enzyme. The claim made by Datta and Meeuse (1955) that it is a flavoprotein is, as yet, not sufficiently supported by experimental evidence: in addition to riboflavin and FMN, various other pigments exert an accelerating action on the oxygen uptake displayed by the mixture of oxalate and dissolved enzyme. Since this accelerating effect is lacking in mitochondrial preparations (a fact which probably cannot be explained on the basis of penetration difficulties), it is concluded that a natural link between oxalate and oxygen is lost in the solubilization of the OA-ox. Procedures for the extraction and partial purification of moss OA-ox. will be given, and the possible role of the enzyme in plant metabolism will be discussed.

MEHLQUIST, GUSTAV A. L., and YONEO SAGAWA. University of Connecticut and Brookhaven National Laboratory. *The Effect of Gamma Radiation on Carnations.* Mutations or bud-sports affecting flower color and other characteristics are common in the carnation. Many of these were found through genetic tests to be somatic in origin. Through the use of gamma radiation it was possible to reproduce many of those found naturally and in addition some not previously seen were obtained. Genetic tests showed that the radiation-induced mutations included both germinal and somatic ones. Of particular interest is the fact that when natural somatic mutants were exposed to radiation a large number of reversions to the normal condition occurred (reversions were 10 to 20 times as frequent as new mutations). This makes it possible to use gamma radiation as a diagnostic tool in determining whether a natural mutation is of somatic or germinal origin.

MEHRA, K. L., and EDGAR ANDERSON. Missouri Botanical Gardens, St. Louis. *Character Association Analysis: Its Use in Grass Taxonomy.* Classification of cultivated plants and weeds often presents a problem to monographers. The study of complexes of associated characters could be used as an analytic tool to understand and to solve some of the taxonomic problems encountered in these plants. The pattern of association of seven morphological characters of the male inflorescence was analysed and compared in thirty-two varieties of *Zea mays* from Southeast Asia and the Americas. Each variety was observed to possess a characteristic pattern of association of the morphological characters of the tassel. The branching index of different tassels belonging to each variety was prepared for seven morphological characters by using the pictorialized scatter diagram method. Different varieties were catalogued according to the ascending order of their respective median tassel-branching index value. One of the weedy complexes of grasses is represented by the genus *Hyparrhenia*. A random collection of twenty-four plants of a *Hyparrhenia* population taken from a disturbed habitat of Ethiopia presented a taxonomic problem. None of these specimens could be put under any described species. Association of seven morphological characters was analysed and by the use of the pictorialized scatter diagram method the presence of a hybrid swarm with introgression between *Hyparrhenia cymbaria* and *H. papillipes* was postulated.

MEHRA, P. N. Panjab University, India. *Cytological Investigations on Some Marchantiales of the Western Himalayas and Panjab Plain.* Twenty-five species belonging to 13 genera of the Marchantiales distributed in the Western Himalayas and Panjab Plain have been investigated by the author with his collaborators. In all these the haploid chromosome number is nine which includes an m-chromosome, except in *Athalamia pinguis* which is diploid and possesses only one m-chromosome in addition to 17 large chromosomes, *Asterella reticulata* and *A. blumeana*, both of which are diploid with $n = 18$, including two m-chromosomes, the monotypic genus *Stephensoniella brevipedunculata* which possesses $n = 8$ and lacks an m, *Cyathodium flabellatum*, *C. himalayense*, *Riccia discolor*, and *R. crystallina* which possess $n = 8$, including an m, and *R. cruciata* and *R. melanospore*, both of which are diploid with $n = 16$, including two m-chromosomes. Of these species eight are strictly dioecious. Meiotic studies undertaken on six of them reveal that in *Asterella angusta* and *Stephensoniella brevipedunculata* there is no heteromorphic bivalent; in *M. palmata* and *Cyathodium himalayense* there is one sub-heteromorphic bivalent which shows only a slight inequality in the size of the homologues; and in *C. flabellatum* and *R. frostii* there is a marked heteromorphic bivalent respresenting an XY mechanism of sex determination. The female plants contain a large X in their chromosome complement which is indistinguishable from the autosome, and the male ones possess a dot-like Y-chromosome. In both of these species the heteromorphic pair is the modified m-bivalent. Polyploidy is present to the extent of 20 per cent of the investigated species in this area. The course of cytological evolution within the Marchantiales is discussed and the bearing of these data on the phyllogeny of the group in relation to the other groups of Hepaticae is brought out.

MEIJER, G. Philips' Research Laboratories, Eindhoven, Netherlands. *The Influence of Light of Different Spectral Regions on the Elongation of Internodes.* Seedlings of various plant species were exposed to light of different spectral regions: red ($\lambda = 6{,}000$-$7{,}000$ Å), green ($\lambda = 5{,}000$-$6{,}000$ Å), blue ($\lambda = 4{,}000$-$5{,}300$ Å) and near infra-red ($\lambda > 7{,}000$ Å). It depends on the light intensity whether blue or red light is the most active spectral region for inhibiting the elongation of internodes: at relatively low intensities red light is more active than blue light; at relatively high intensities red light is less effective than blue light. This implies that at a certain "critical intensity" red and blue light are equally effective. The absolute value of this critical intensity depends on the plant species: for tomato, *Mirabilis jalapa*, and *Hyoscyamus niger*, it is much lower than it is for gherkin and bean. The inhibiting effect of red light on the elongation of gherkin seedlings is much more pronounced when the seedlings are pre-irradiated with white or blue light. Near infra-red and blue light antagonize the inhibiting effect of red light on the hypocotyl of gherkin seedlings, germinated in white light.

Meiklejohn, Jane. Rothamsted Experimental Station, Harpenden, England. *Notes on the Distribution of Free-living Nitrogen Fixers.* Many soils, even fertile soils, do not contain any *Azotobacter* species. Where *Azotobacter* does occur, the numbers are very small, rarely exceeding 1,000 cells per gram of dry soil. The fluctuations in numbers of *Azotobacter* in different plots of a Broadbalk wheat field at Rothamsted have been followed over a four-year period.

Nitrogen-fixing *Clostridium* species, on the other hand, are almost universally present in cultivated soils, and in much greater numbers than *Azotobacter*, usually ten to a hundred thousand per gram of dry soil. It seems improbable that *Azotobacter* spp. can be important as nitrogen fixers in nature. Possibly most of the fixation which occurs in ordinary field soils is due to Clostridia; or it may be due to the combined activities of the many species that can fix small amounts of nitrogen.

Melhorn, W. N. *See* **Beals, H. O.**

Menendéz Amor, Josefa, et F. Florschütz. Madrid, Espagne, et Velp, Netherlands. *La Végétation tardiglaciaire aux Pyrénées Centrales françaises et en Espagne septentrionale: B, Espagne septentrionale.* Les résultats de l'analyse pollinique de sédiments dans la Laguna de las Sanguijuelas (Lago de Sanabria, province Zamora) et la Cueva del Toll (Moiá province Barcelona), combinés avec dates-C^{14}, fournies par Hl. de Vries, Groningue, donnent une impression du développement de la végétation tardiglaciaire en Espagne septentrionale. Les diagrammes permettent de distinguer: Dryas inférieur (I): le plus ancien Dryas (I*a*), Bølling (I*b*), ancien Dryas (I*c*); *Allerød* (II); Dryas supérieur (III). Diagramme de Laguna de las Sanguijuelas: I*a*: paysage de parc; prédominance de *Pinus*; I*b*: forêts légères; prédominance de *Pinus* et *Betula*; I*c*: paysage de parc: prédominance de *Pinus*; II: forêts denses, respectivement de *Betula* et *Pinus* (II*a*); *Pinus* et *Betula* (II*b*); *Pinus* et *Quercus* (II*c*); III: forêts légères; prédominance de *Betula* et *Pinus*. Dates C^{14} (avant ± 1950): commencement du Bølling ± 13.700; milieu du Bølling ± 12.800; commencement de l'Allerød ± 11.600. Pendant certaines phases du Dryas inférieur, abondance d'*Artemisia*, présence de *Chenopodiaceae, Ephedra, Helianthemum, Hippophaë*. Supposition: paysage steppique à arbres dispersés. Opulente végétation d'Isoetes. Diagramme de Cueva del Toll: I*a*: paysage de parc; I*b*: forêts légères; I*c*: paysage de parc; II: forêts légères, alternantes avec forêts denses; III: paysage de parc. Toujours forte prédominance de *Pinus*. Pendant le Dryas inférieur, abondance d'*Artemisia* (sauf dans le Bølling), présence de *Chenopodiaceae* et *Ephedra*. Probablement paysage steppique à *Pinus*.

Messeri, Albina, and Cecilia Ruggeri. Centro Sperimentale, Roma. *Numero cromosomico di Eucalyptus × trabutti Vilmorim (Myrtaceae). Eucalyptus ×*

trabutti, ibrido spontaneo (*E. camaldulensis* Dehn. ♂ × *E. botryoides* Sm. ♀, segnalato da Trabut nel Marocco francese, oggi bene acclimatato in Italia. Nel genere *Eucalyptus*, 36 specie studiate hanno corredo $2n = 22$; *E. corynocalix* ed *E. redunca*, aneuploidi, $2n = 24$. Abbiamo analizzato gli apici radicali di plantule dell'ibrido e genitori, da seme dell'Agro Pontino, trattati con colchicina (0,2% ca. h.3) e fissati in 2BD La Cour o Carnoy modofocato. Nello striscio al Feulgen (metodo D'Amato) la colorabilità dei cromosomi, piccoli, migliorò con preidrolisi a freddo (HCL conc. + alcool 95°, parti uguali). Il conteggio è stato eseguito in stadi di prometafase-metafase. Il numero cromosomico in *E.* × *trabutti* risulta $2n = 22$, come nei genitori. I cromosomi di ca. micron 1,2 - 2,5, presentano costrizione primaria submediana e talvolta secondaria subterminale, determinante un satellite puntiforme. I cariogrammi dell'ibrido e dei genitori risultano molto simili, tranne leggere differenze della lunghezza e della posizione del centromero, da attribuirsi anche alla diversa contrazione cromosomica.

METCALFE, CHARLES RUSSELL. Royal Botanic Gardens, Kew, England. *The Anatomical Approach to Systematics.* A brief review will be given of work on the comparative anatomy of angiosperms which is in progress in different parts of the world since the review that was presented to the Eighth International Botanical Congress in Paris. Particular attention will be devoted to work on the comparative anatomy of monocotyledons and especially to work undertaken by the speaker and his co-workers at the Jodrell Laboratory at Kew, and by botanists who are closely associated with the Kew work. This will provide an opening for the more specialized contributions by subsequent speakers.

MEYER, CONRAD F. Rutgers, The State University, New Jersey. *The Development of the Cotyledons and Hypocotyl during the Late Embryogeny of the McIntosh Apple.* Late embryogeny begins with the protrusion of the cotyledonary primordia. The primordia consist of residual meristem (RM). Later, the ground meristem (GM) develops and reduces the RM to a plate which becomes dissected into three dark-staining strands and the marginal meristem. The latter increases the size of the cotyledons by producing more RM. New strands of RM are outlined and old strands extended, as the GM develops. The first procambial cells appear in the RM at the bases of cotyledonary primordia 100 μ long. The procambium develops upward into the cotyledonary strands of RM and directly downward into the ring of RM in the hypocotyl. The first xylary procambial cells appear at the bases of cotyledonary primordia 300 μ long. Outer adjacent procambial cells remain dividing. As the primordia enlarge, a complex network of procambial strands develops and the number of xylary units increases within them. Many of the minor procambial strands form from the GM between the major strands. Large amounts of aleurone granules accumulate throughout the embryo, beginning in the least meristematic cells. After the hypocotyl ceases linear growth, its number of cells increases by a series of transverse divisions.

MIA, A. J. North Carolina State College. *Shoot Apex of Rauwolfia. Rauwolfia vomitoria,* a member of the family Apocynaceae, is a woody shrub with verticilate branching. Its roots contain a well-known alkaloid—reserpine—which reduces hypertension and has a tranquilizing effect. The shoot apex of *Rauwolfia* varies, with the change of plastochrone, from entirely flat to a strikingly concave shape. In median longisection the tunica (following Schmidt's terminology) is three to five layers of cells thick. It becomes distinctly stratified when the shoot apex is in the phase of minimal area. The corpus consists of a group of cells, which divides in all planes. Corpus cells are comparatively large and more vacuolated than the surrounding cells, except those immediately below them. Groups of closely related cells, both in tunica and in corpus, remain surrounded by thick original cell walls, with thickening at the corners. The corpus is delimited below by three to five layers of cambium-like cells, which are highly vacuolated and usually divide at right angles to the radii centering at the summit of the shoot apex. In cross-sections through the tunica, the procambium and maturing tissues surrounding the tunica are seen to merge with the apical meristem, a condition peculiar to *Rauwolfia.*

MICHELINI, FRANCIS J., and VICTOR C. RUNECKLES. Wilkes College, Pennsylvania. *The Use of a Developmental Index in Studies of Leaf Chemistry and Differentiation.* Developmental studies in higher plants have been seriously hampered by the difficulty of obtaining parallel samples of the experimental materials. When chronological age is used as a selecting criterion in such studies, reproducibility is very limited. Recent advances in biochemical and physiological knowledge have brought an increase in the understanding of many of these specific reactions involved in growth and differentiation and make more important the linking of these processes to development. Utilizing a previous, established formula, the Plastochron Index for expressing development in terms of leaf morphology, it was found that cytological and physiological changes in the leaf could be correlated very precisely with this index. Cytological analysis of lamina development has shown that differentiation in the leaf occurs at specific plastochron values. This enables one to study various constituents of the leaf before, during, and after differentiation. Various metabolic substrates, fructose, glucose, sucrose, total fructose, total sugar, and free reducing power were measured quantitatively over the period of development of the leaf. No deviations in the normal rates of synthesis of these materials were apparent during the period of differentiation. Nitrogen analyses of the developing leaves also failed to show any deviation in rate of synthesis during differentiation. Results of immunochemical analyses of leaf material of selected plastochron ages covering undifferentiated leaves, leaves in the process of differentiation, and fully differentiated leaves will also be discussed.

MIDDLETON, JOHN T. University of California. *Air Pollution Injury to Plants by Ozone.* Oxidant injury to plants, including agricultural crops, was first reported from the Los Angeles area in 1944. The chemicals responsible for this injury result from the photochemical oxidation of nitrogen oxides and organic materials in the presence of sunlight. The phytotoxicant responsible for oxidant damage has not been chemically identified but is believed to be an oxygenated hydrocarbon and possibly a hydroxy hydroperoxide. The symptoms of plant injury due to ozone are distinct and different from those due to oxidant. Ozone injury was not observed in the Los Angeles area until 1954. Since that time, ozone has been found to cause serious damage to many plants and most important agricultural crops. Ozone damage seems to increase as organic contaminants are removed from the atmosphere.

MIDDLETON, JOHN T. *See* BAXTER, DOW V.

MIKHALEVA, E. N. *See* KONOVALOV, I. N., *et al.*

MIKI, S. Osaka City University, Japan. *Floral Composition of Fossil Gymnosperms and Gamopetalae in Japan.* Certain Japanese fossil gymnosperms and angiosperms (Gamopetalae) were analyzed and identified. Twenty-three genera of Gymnosperms were recognized as distributed in five families. Twenty-eight genera of Gamopetalae distributed in thirteen families were also recognized. This material will be discussed in relation to modern species, geological ages, ecological composition, and origin of Japanese gymnosperms.

MILLER, H. A. *See* KUWAHARA, YUKINOBU

MILLER, HARVEY A. Miami University. *Distribution Patterns of Pacific Island Bryophyta.* Analysis of the distribution of widespread species and the taxonomic relations of endemics has revealed patterns which suggest a series of migration tracks and a relative chronology of these migrations. The bulk of the tropical Pacific bryoflora is derived from southeast Asia, Java, Sumatra, and Borneo, although secondary centers of distribution of this element are located in New Guinea. The bryoflora of high Pacific Islands contains a marked austral element composed of species known elsewhere—for the most part, only from New Zealand. In general, the bryoflora of Polynesia and Micronesia has very weak ties with the American flora. The American element is essentially restricted to Hawaii. The Micronesian bryoflora appears to have originated from one center in eastern New Guinea and the Admiralties and a second center further west in the vicinity of the Celebes. The southern Polynesian islands are predominantly Indomalayan in their bryophyte flora, but there is a strong austral element present, especially on the higher islands. The Hawaiian flora, although predominantly Indomalayan, also contains austral, American, and Asian elements which have arrived in a series of migrations.

MILLER, HELENA A., and H. J. KLINE, Duquesne University; and A. V. WEBER, Wisconsin State University. *The Development of the Androecium, the Gynoecium, and the Embryo of Chenopodium ambrosioides L.* The five stamen primordia of the androecium differentiate into filament and anther, the anther being formed by divisions in the second layer of cells below the surface in the apical region. Four sporangial regions are eventually delimited, each surrounded by a tapetal layer, two or three other layers, and the epidermis. Reduction division occurs in all the cells of the sporangia, producing haploid spores in the tetrahedral arrangement. The nucleus of each spore divides, and the wall becomes covered with a thin exine, thus forming a spherical, foveate-reticulate pollen grain which is shed when the anther splits longitudinally. The three carpel primordia of the gynoecium form a unilocular ovary with a single basal ovule. The early development of the ovule is typically anatropous, but later the funiculus elongates to the extent that the ovule is bent in a fashion similar to the first turn of a helix. The archesporial cell usually appears in the second layer of cells below the margin of the nucellar bulge, which, as yet, is not covered by integuments. The inner of the two cells formed by its division develops into the typical monosporic *Polygonium* embryo sac (normal). The egg is fertilized and becomes a pro-embryo, following the chenopodiad type of development only in so far as both cells of the two-celled pro-embryo, and all four cells of the four-celled pro-embryo, contribute to the later embryo. The order of division of the four cells, and all subsequent cells, was observed to vary somewhat, but was never observed to be identical to any of those patterns reported for the chenopodiad type. The linear pro-embryo first forms a spindle-shaped base on the suspensor and then a ball-shaped embryo on the opposite end. For a limited time before the suspensor ceases its growth, the diameters of both the spindle at the base and the ball at the top of the suspensor are the same. The development of the embryo beyond the ball-shaped stage is similar to that described for *Phlox drummondii* Hook.

MILLER, J. A. *See* BENSON, A. A., *et al.*

MILLER, J. J. McMaster University. *Influence of Certain Nutritional Factors on Yeast Sporulation.* Ascospore formation and growth in *Saccharomyces cerevisiae* seem mutually exclusive processes since actively growing cells do not sporulate, and cells that have been in sporulation medium for a certain length of time do not begin to bud on transfer to growth medium without first forming spores. Whereas growth requires assimilable carbon and nitrogen sources, minerals, and one or more B vitamins, sporulation can occur in distilled water or buffer, but usually the inclusion of a carbon source such as acetate, pyruvate, ethanol, or glucose stimulates highly. The last two substances should be in low concentration, 0.01-0.1 per cent, as above this level they inhibit strongly. Other inhibiting factors are anaerobiosis, carbon dioxide, and ammonium sulfate. Cells nitrogen-starved in growth medium sporulate poorly on transfer to buffer + acetate. The antimetabolites ethionine and 2,6-diaminopurine are potent sporulation inhibitors, the effect being reversed by the normal metabolites methionine and adenine. These results with *Saccharomyces* parallel in many respects the findings of those studying endospore formation of aerobic bacilli, indicating that sporulation physiology is to some degree similar in both.

MILLER, LAWRENCE P. Boyce Thompson Institute for Plant Research, Inc., New York. *Factors Affecting the Uptake of Toxicants by Conidia.* Experiments with various toxicants and conidia of *Neurospora sitophila, Monilinia fructicola, Alternaria oleracea, Glomerella cingulata, Aspergillus niger, Rhizopus nigricans, Stemphylium sarcinaeforme,* and cells of *Saccharomyces cerevisiae* have shown that there are marked differences in the amount of toxicant taken up when the organisms are exposed under comparable conditions. The differences are not related to the size of the conidia, that is, the amount of surface area per unit weight, but apparently occur because of variations in the membranes controlling uptake and because of quantitative and perhaps qualitative differences in the receptor sites available. The quantities of toxicant taken up may vary as much as ten-fold between species. Species comparatively more permeable to one toxicant do not necessarily react similarly to a different toxicant. The simultaneous presence of other ions or compounds during exposure to a toxicant may affect uptake even if the interfering substances are chemically unrelated to the toxicant. Here too there may be marked differences between species. For example, small amounts of cerium retard the uptake of silver by many species but have no effect with yeast cells. In general, passage of materials into and out of conidia takes place quite readily.

MILLER, R. A. *See* ZALIK, SAUL

MILNE, R. G. *See* SELMAN, I. W.

MIRANDA, F. Universidad Nacional de Mexico. *The Possible Significance of Percentages of Bicontinental Genera in Tropical America.* Bicontinental genera are those whose geographic area of distribution extends beyond the limits of one continent. Provisional analysis, based on percentage of bicontinental genera in arboreal associations in tropical humid American regions and in tropical genera of Eocene formations, showed the following features. Mountainous and marshy areas, especially those on the coast, give the highest percentages: in these, the higher values are along the northern and southern tropical limits with a decrease toward the equator. The high bicontinental percentage found in North American Eocene floras is not matched in existing tropical floras. Commonly, the bicontinental genera in tropical America have extensive areas of distribution: a good number are pantropical, but those from low-lying areas show greater affinity with Africa, those from mountainous with Asia. From this, it may be deduced that a flora similar to that found at present in mountainous and marshy areas had greater diffusion in past periods; later it was partially dominated in tropical zones by a more macrothermic flora, and was almost eliminated in North America by a more microthermic flora. During the periods of greatest diffusion of mountainous and marshy floras, temperatures in tropical America could have been slightly lower than at present.

MIRANDA, F. *See* GARCIA, ENRIQUETA, *et al.*

MIROV, NICHOLAS T. California Forest and Range Experiment Station, U.S. Forest Service. *Biochemical Geography of the Genus Pinus.* The genus *Pinus* consists of about 100 species scattered throughout the northern hemisphere. Volatile oils (turpentines) obtained from oleoresins of 94 species of pines have been analyzed by several investigators, chiefly by the author and his associates. When the occurrence of the chemical components of pine turpentines is indicated on a map, a pattern is evident in their geographical distribution. The distribution of the following components is considered as an example: α-pinene, β-phellandrene, Δ^3-carene (all three $C_{10}H_{16}$); two sesquiterpenes ($C_{15}H_{24}$); a diterpene ($C_{20}H_{32}$); paraffin hydrocarbons, chiefly n-heptane (C_7H_{16}); and aliphatic aldehydes. A striking feature of geographical distribution of the chemical components of pine turpentine is that generally the same or very similar substances are found in western America and in eastern Asia, on both sides of the Pacific. This relationship appears to indicate that the center of origin of the genus *Pinus* was the land mass, now not existing (Beringia?), that lay between northern parts of America and Asia. Furthermore, it appears that a majority of the European species of the genus arrived at their present locations via northeastern America, whereas *Pinus sylvestris* and the Balkan pine (*P. peuce*) came to Europe from the east across Asia. There is chemical evidence of an ancient hybridization between *Pinus sylvestris* and some eastern Mediterranean pines.

MITRA, JYOTIRMAY. *See* RANDOLPH, L. F.

MITSUI, SEIJI, KÔZÔ HAYASHI, and SHIZUO HATTORI. Tokyo University of Education and University of Tokyo. *A Blue Crystalline Metallo-anthocyanin from the Flowers of Commelina.* From the blue petals of *Commelina communis,* an anthocyanin is isolated in blue crystals, to which the name "commelinin" is given. After complete hydrolysis by boiling, 20 per cent hydrochloric acid, delphinidin (as chloride 27.33 per cent), and glucose (30.78 per cent) were found. Also *p*-coumaric acid (11.83 per cent) was found after saponification with 10 per cent NaOH. It must be pointed out that commelinin also contains 0.42 per cent Mg and 1.47 per cent K as integral parts. Na is sometimes found in the preparation, suggesting its migration during crystallisation. K is believed to be present as phenolic salt, since it is removed by treatment with cold 1 per cent hydrochloric acid and the pigment crystallizes in blue rectangular platelets. Moreover, after treatment with acetic acid + HCl, a dull brownish yellow, fluorescing, water-soluble substance arises, which is not the usual flavone or flavonol and awaits further investigation. Summarizing our experimental data, we consider the structure of commelinin is a metallo-anthocyanin, in which four molecules of awobanin (delphinidin-3, 5-diglucoside + *p*-coumaric acid) build with one atom of Mg a co-ordination compound. K may play a role in making phenolic salt. Also, the brownish yellow substance participates in completing this co-ordination compound with probable ability to stabilize the blue color.

MITTLER, TOM E. Bee Research Station, Hillerød, Denmark. *Aphids and Their Supply of Sieve-Tube Sap.* Investigations into the feeding of aphids have shown that plants may supply these insects with large amounts of phloem sieve-tube sap under pressure. It appears that aphids are actually fed physically as well as chemically by these host plants. Botanically speaking, therefore, aphids may be regarded as perfect "sinks" into which all constituents of the sieve-tube sap empty. These sinks probably depend on the same translocatory processes as normal plant sinks to maintain their supply of water and solutes. In general, the distribution of aphids on the host plants suggests that aphids preferentially tap sieve tubes supplying existing plant sinks, i.e., regions of normal or abnormal growth. As aphids require large amounts of nitrogenous matter for their growth and reproduction, it may be supposed that the sap they obtain from sieve tubes supplying such plant sinks is relatively rich in these materials. An abundance of nitrogenous materials in the sap of sieve tubes draining senescent leaves may similarly account for the selection by aphids of these elements as feeding sites. A heavy aphid infestation may force a plant to mobilize its tissue nitrogen and cause its premature senescence. In general, however, aphids exploit and perhaps enhance the sap flow to existing plant sinks rather than create and maintain sinks which may divert the normal sap flow in the sieve tubes.

MIYACHI, S. *See* OH-HAMA, T., *et al.*

MOEWUS, FRANZ. Applied Research Laboratories, Miami Springs, Florida. *Studies on Some Regulators of Mitotic Activity and Their Antagonists.* The investigation was carried out with two biological systems: *Polytoma uvella* and *Astasia longa.* Both organisms grow fast in a semi-defined medium. Experiments can be evaluated after 22 (*Polytoma*) and 48 (*Astasia*) hours. The number of cells produced within a culture period is strictly controlled by the dosage of trypticase in the medium. Agents which are non-nutritional, yet enhance mitotic rates, shorten the nuclear doubling time, but do not influence the final cell yield. Experimental data are collected by comparing nuclear counts of exponentially growing cultures. After it had been established that kinetin (= 6-furfurylaminopurine) enhances mitotic activity up to 120 per cent and is competitively counteracted by 8-azaguanine, other antimetabolites, known as structural analogues of nucleic acid components, were tested in order to elucidate the role of kinetin in DNA synthesis. Besides, it was found that carcinogens (fluorene derivatives) are even more active than kinetin. The enhancement caused by N-1-diacetylaminofluorene could be suppressed by 8-azaguanine. The information obtained by screening other antimetabolites during enhanced mitotic activity provides a basis for speculation whether the mentioned carcinogens interfere with DNA synthesis.

MOHAN RAM, H. Y. Cornell University. *Embryological Characters in the Classification of the Acanthaceae.* Lindau divided the Acanthaceae into four subfamilies: Acanthoideae, Nelsonioideae, Thunbergioideae, and Mendoncioideae. Bremekamp recognizes great heterogeneity in the family and remarks that there is not a single morphological characteristic which would delimit the Acanthaceae from its allies. He raises Thunbergioideae and Mendoncioideae to the status of individual families, and transfers Nelsonioideae to the Scrophulariaceae, near the tribe Rhinantheae. Bremekamp's criterion for such treatment is the albuminous condition of the seeds in the Nelsonioideae and the exalbuminous nature of seeds in the rest of the Acanthaceae. Rhinantheae and Nelsonioideae have the following embryological characters in common: (1) numerous amphitrophous ovules, (2) presence of endothelium, (3) absence of jaculators, (4) globular and albuminous seeds. In *Elytraria*, the only genus of the Nelsonioideae whose embryology is known, the first two endosperm divisions are transverse; while in the Rhinantheae the first division is transverse, the second may be transverse or longitudinal. To consider the seeds of the Nelsonioideae alone to be albuminous is wrong, for those of *Andrographis serpyllifolia* (subfamily, Acanthoideae) have copious persistent endosperm. Further, *Andrographis* and *Elytraria* exhibit a central endosperm chamber which is *ab initio* cellular. It seems unsound to accept Bremekamp's drastic systematic shunting of the Nelsonioideae based on a single character of the seed. More embryological data of this group need to be gathered.

MOHR, HANS. University of Tübingen. *The Photochemical Control of Anthocyanin Synthesis and Correlated Photomorphogenesis in Dark-grown Seedlings of Sinapis alba L.* In these seedlings the light dependent synthesis of anthocyanin is controlled by two photoreactive systems. The one system is the well-known "reversible red–far-red reaction system" (low energy reaction), the other is a high energy reaction system which can be called — in reference to the action peaks in the far-red and in the blue — "blue–far-red reaction system." Besides anthocyanin synthesis these two photoreactive systems control also all photomorphogenic responses of those seedlings which have been so far investigated, for example, inhibition of lengthening of the hypocotyl, formation of hairs from epidermal cells of the hypocotyl and expansion of the cotyledons. The two reaction systems have been physiologically separated. This separation opened the possibility of determining a precise action spectrum of the "high energy reaction." The action spectrum which shows a strong peak in the far-red and a smaller one in the blue is corrected approximately for the influence of the reversible red–far-red reaction system. Our findings indicate that the influence of light on the biosynthesis of anthocyanin is an indirect one. A working hypothesis has been advanced which accounts for the present facts derived from experiments.

MOIR, DAVID ROSS. North Dakota Agricultural College. *Floristic Aspects of the Severn River Drainage Basin of Northwestern Ontario.* Recent field work in the Severn River drainage in a north-south transect from near the height of land on the Precambrian Shield to the coast of Hudson Bay has provided a relatively complete picture of the flora of this region. The flora consists of a large nucleus of wide-ranging boreal species to the south, with the northern portion of the area made up of the more northerly ranging of these elements, intermingled with truly arctic species along the coast. The area as a whole is strikingly deficient in ferns and fern allies owing largely to the paucity of suitable habitats and to some extent insufficient time lapse since deglaciation to allow their migration northward. Despite the impeded drainage and monotonously uniform aspect of much of the Hudson Bay coastal plain, a relatively rich flora, comprising some six hundred species, is present. The greatest diversity of species occurs along the drainages where renewingly disturbed habitats are available for colonization.

MOLLENHAUER, HILTON N. *See* WHALEY, W. GORDON, *et al.*

MOORE, R. MILTON. C.S.I.R.O., Canberra. *Sub-alpine Treeless Grasslands in Southeastern Australia.* The treeline on Mt. Kosciusko is approximately 6,600 feet above sea level, but treeless areas, varying in size from a few to a hundred acres or more, occur at approximately 4,000 feet, and some even at altitudes below 2,000 feet. The grasslands at 4,000 feet are composed principally of *Poa caespitosa* Forst. and occupy the floors of shallow valleys, the sides of which are covered with woodlands of *Eucalyptus pauciflora* Sieber. A study was made of the factors governing the absence of trees on the valley floors. The occurrence of nocturnal temperature inversions in the valleys was established and records taken during a two-year period showed that temperatures below 18° F. were frequent below the treeline and could occur during any month of the year. Above the treeline such low temperatures were absent or rare. The unsuitability of the grassland environment for trees was confirmed by experimental plantings, and the sensitivity of young trees of *E. pauciflora* to temperatures below 18° F. was established experimentally in a cold-box. An explanation is given of the opposing effects of topography and mature tree cover on the micro-environment of young trees.

MOORE, RAYMOND J. Canada Department of Agriculture. *Evolution in the Genus Buddleia.* It is suggested that the primitive *Buddleia* inflorescence consists of a dichasium of small flowers borne in the axil of opposite leaves on the terminal portion of the branch. Evolution has progressed by combinations of several processes: reduction in leaves subtending the flower groups, change in the number of floriferous nodes, change in the number of flowers in the clusters, change in length and texture of the pedicels and peduncles of the clusters, growth of peduncles to form a branched inflorescence. The major inflorescence types have arisen at the diploid level; these processes can be seen in New and Old World species. A collection of 23 Old World and 5 American species has been made. Eighty interspecific crosses have been attempted and 18 hybrids have been obtained. Some represent crosses between different inflorescence types; the hybrid inflorescence is generally intermediate. Crosses between many Old World species are easily made; those between Old World and Asiatic species are more difficult. One such hybrid has been obtained (*alternifolia* × *brasiliensis*). Characters of the Asiatic species are dominant to a high degree and the inflorescence suggests reversion to a more primitive level. Concepts of interspecific relationship are presented.

MOORING, JOHN S. State College of Washington. *The Evolutionary Role of Translocations in Clarkia unguiculata (Onagraceae).* The evolutionary importance of large rings of chromosomes in certain subgenera of *Oenothera* is well known. This paper represents an attempt to assess the role of smaller translocations in *Clarkia unguiculata*, a colony-forming annual native to California. Examination of microsporocytes has shown that over 35 per cent of the individuals sampled from natural populations were heterozygous for at least one translocation. Individuals with only four chromosomes involved in a ring or chain were much more frequent than those which had a catenation of six or eight chromosomes, or two or more catenations involving a total of eight, ten, twelve, or fourteen chromosomes. The translocation heterozygotes occurred throughout practically the entire range of the species and comprised from zero to 79 per cent of the populations sampled. No evidence of a center of structural heterozygosity was found, nor, in general, was the heterozygosity better developed along the margins of the species. Five different chromosome arrangements were identified from structural homozygotes. One of these was frequent and widespread, the other four were sporadic and localized. The high frequency of translocation heterozygotes is probably due largely to heterozygote superiority rather than to hybridization, frequent chromosome breakage, or the presence of lethals.

MORELLO, JORGE. *See* SINGER, ROLF

MORITZ, OTTO. Universität Kiel. *Serologie als Methode biologischer Verwandtschaftsforschung.* Vergleichende botanische Serologie ist die Lehre von der Verteilung antigenisch wirksamer Substanzen, insbesondere von Eiweissantigenen, im Pflanzenreich. Folgende Anschauungen werden bezüglich der Bedeutung dieses Gebietes für die Systematik vertreten und zu begründen versucht: (1) Es nimmt eine Sonderstellung innerhalb der systematischen Methoden ein, da die Proteine Merkmale geringer Konvergenzwahrscheinlichkeit sind. (2) Vergleich der Zahl gemeinsamer Merkmale bei verschiedenen Organismen ist der Systematik wesensgemäss, nicht Vergleich der quantitativen Ausprägung eines Merkmals. (3) Demnach hat Phytoserologie Antigenmerkmale qualitativ zu erfassen und den Grad der serologischen Übereinstimmung mehrerer Organismen nach der Zahl gemeinsamer Merkmale zu bestimmen, nicht aber nach der wägbaren Quantität reagierenden Materials. (4) Serologische Methoden können diesem Zweck angepasst werden durch Ausbildung durch Absättigungsmethoden, Geldiffusionsmethoden, Misch- und Hemmungsmethoden. Anwendung solcher Methoden und ihrer Interpretation für systematische Zwecke wird vor allem an Reaktionen aus dem Gebiet der Rhoeadales demonstriert.

MORQUER, RENÉ. Faculté des Sciences de Toulouse. *Modification du cycle de quelques Urédinales sous l'action du climat alpin.* On observe sous les climats alpin et arctique une proportion d'Urédinales à microformes plus élevée que dans les plaines. Cependant un tiers des espèces alpines conservent leur aptitude à produire des urédospores dans la zone supérieure. Aussi ai-je recherché expérimentalement le déterminisme de la réduction du cycle sporal en comparant deux races biologiques voisines *Trachyspora alchimillae*, hémiforme parasite d' *Alchimilla vulgaris* et *Tr. melospora*, microforme attaquant *A. hoppeana*, cultivées pendant 5 ans à Toulouse, Bagnères et au Pic du Midi, de 80 à 2830 m. d'altitude. Le stade à urédospores est seulement abrégé dans sa durée; les urédospores et les probasides tendent à se condenser en sores mixtes à haute altitude. La proportion de 99 pour cent de probasides chez la microforme *Tr. melospora* se maintient en plaine. Comparant mes résultats expérimentaux avec la coexistence des microformes et des hémiformes de même espèce signalées sous le cercle polaire, j'ai envisagé l'établissement d'un nouvel équilibre par mutation sporadique, conduisant à l'individualisation de la microforme. Celle-ci coexisterait temporairement avec l'hémiforme, moins bien adaptée au refroidissement nocturne et destinée à disparaître.

Morris, Meredith J. *See* Hutchings, Selar S.

Morrison, J. W., and T. Rajhathy. Canada Department of Agriculture. *Cytogenetic Studies in the Genus Hordeum.* The paper covers the current research in the study of chromosome morphology, hybridization, and the genome relations of many species of the genus *Hordeum.* Based on the morphology of the plants and also on details of chromosome morphology, several species groups have been designated. Chromosome numbers of 14, 28, and 42 have been found for some species groups. The results of crossing within and between these groups and the relationship of the species will be discussed. Hybridization with two other genera, *Secale* and *Hordelymus,* has been accomplished.

Morrison, J. W. *See* Rajhathy, T.

Morrison, M. S. Université de Montréal. *Cytotaxonomy of the Genus Trisetum. Trisetum spicatum* occurs in Europe and North America. In North America, Fernald places three varieties under the species. These are var. *maidenii*, var. *molle*, and var. *pilosiglume. T. spicatum* from Europe and North America has 28 somatic chromosomes, var. *maidenii* 28, var. *molle* 42, and var. *pilosiglume* 42. *T. spicatum* var. *maidenii* was named by Gandoger on the basis of Australian plants, but a wide survey of North American material fails to prove its existence in this area. *T. spicatum* var. *molle* being hexaploid appears to deserve specific rank, while var. *pilosiglume*, the most easily recognized of the varieties, may be regarded as a variety of the latter. A search for lower chromosome numbers reveals *T. subalpestre* with 24, and *T. sibiricum* and *T. paniceum* both with 14. These diploids are unlikely ancestors of the *T. spicatum* line, differences being indicated in anatomy and chromosome morphology. A complete survey of the genus, which seems heterogeneous and with leanings towards nearby genera such as *Koeleria*, would be an excellent point of departure for a wider survey that could give a fresh basis for reassorting the intergrading groups which lie between the extreme members of the Aveneae and Festuceae.

Mortimer, D. C. *See* Clauss, H., *et al.*

Mortimer, Donald C. National Research Council of Canada. *Some Effects of Graded Iodoacetate Inhibition on Photosynthetic Assimilation Patterns in*

Sugar Beet Leaves. Petioles of illuminated sugar beet leaves were immersed in solutions of iodoacetate (0.005 to 0.02 *M*, at pH 6) for 5 to 15 minutes. The total carbon dioxide taken up by these leaves was reduced under maximum inhibition to about 20 per cent of the control. The distribution of C^{14} among the products of 30 or 60 seconds of photosynthesis in $C^{14}O_2$, without and with subsequent flush treatment in air, was determined. A gradient of inhibition effects was established from the base to the tip of the leaf by the short exposures to iodoacetate. At low concentrations, the proportion of C^{14} in serine and glyceric acid was reduced, while that in aspartic acid was greatly increased. Sucrose was formed at low and intermediate concentrations of iodoacetate. In the flush treatment, sucrose accumulated less and aspartic acid more C^{14} than did control leaves. Aspartic acid accumulation showed no apparent relation to malic acid metabolism. The highest level of iodoacetate limited the products of photosynthesis to malic, aspartic, and phosphoglyceric acids. These data strengthen the possibility of a second pathway from carbon dioxide to sucrose which does not pass through triose phosphates.

Morton, John K. University College of Ghana. *The Incidence of Polyploidy in a Tropical Flora.* An investigation into the incidence of polyploidy in West Africa is being undertaken in order to provide data for comparison with that from temperate regions. Two large cosmopolitan families, the *Labiatae* and *Compositae,* are being used in order to facilitate comparison. All the species belonging to these families are being examined in two areas: Ghana (a lowland tropical region which has not been subject to violent environmental change) and the Southern Cameroons (a mountainous area subject to volcanic upheavals of the environment). Additional data are being obtained from the "European Element" of the Cameroons Mountain flora. Preliminary results suggest a higher incidence of polyploidy in the Cameroons than in Ghana, though neither is as high as that occurring in the flora of northwest Europe.

Moseley, M. F. University of California. *Vascular Anatomy and Morphology of the Flower in Nymphaea.* In syncarpous *Nymphaea,* a single central and eight or more peripheral pedicellar vascular strands terminate in a receptacular vascular disc. The large pedicellar strands consist of two collateral vascular bundles, radically adjacent, the inner inverted. The smaller strands are collateral bundles. A single trace, originating at the lower margin of the vascular disc, supplies each sepal. Several larger strands originate from the upper margin of the disc as radially paired, normally oriented, collateral vascular bundles. The inner bundle may represent the dorsal carpellary supply; the outer the fused stamen and petal supply. Small branches contribute to the septal ovular vascular network, and supply dorsally borne ovules. The three bundles in the stylar processes are continuations of the dorsal and ventrals. The ventral vascular bundles typically originate from the paired bundles, anastomose among themselves, with residual vascular tissue, and the dorsal bundles, and contribute to the septal vascular system. The nature of the ovary wall is problematical, but the outer wall is probably appendicular and carpellary, the inner column receptacular and carpellary. The lateral walls of the carpels are separate in some species, fused in others. Ventral sutures in the stigmatic region are open, or closed by enmeshed stigmatic hairs.

Moseman, J. G. *See* Powers, H. R., Jr., *et al.*

MOSES, MONTROSE J., and JEAN G. LAFONTAINE. The Rockefeller Institute, New York, and Institut du Cancer, Hôpital Notre-Dame, Montreal. *Components of the Nucleus at Interphase and during Division.* The highly ordered metamorphosis undergone by the nucleus as it passes from interphase through the mitotic cycle is familiar from light microscopy. It is recognized as a morphological manifestation of a shift in chromosome function with respect to the genetic elements. In interphase the chromosome is presumably so disposed as to enable the genetic material to engage directly in physiological activities of the cell, which are also manifested in the behavior of the nucleolus and other components of the nucleoplasm. In mitosis, structure and behavior are directed toward the replication, preservation, and distribution (to daughter cells) of the genetic pattern. It is reasonable to expect further structural evidence of this functional shift at the electron microscope level. From such evidence should emerge the underlying pattern of chromosomal organization. By means of closely correlated light and electron microscopy, a study has been made of the changes in nuclear fine structure from interphase through the mitotic cycle in meristem cells of root tips. Mitotic stages have been identified with the light microscope and characterized cytochemically. Autoradiographic techniques have been employed to distinguish nuclei in which replication has occurred. As has also been reported by other workers, a ubiquitous component of chromatin is a kinked microfibril of the order of 100Å in diameter, possibly further divisible into subunits. The pattern by which such microfibrils are integrated to form a chromosome is obscure in the somatic nuclei studied. However, microfibrils are clearly integral with the linear axial elements observed in meiotic (synaptic) chromosomes and emerge radially from them. From studies on the organization and behaviour of this axial complex, a scheme of chromosomal organization has emerged which will be discussed with respect to the somatic cells studied.

MOSQUIN, THEODORE, and HARLAN LEWIS. University of California. *Variation in Relation to Reciprocal Translocations in a Diploid Species of Clarkia (Onagraceae). Clarkia speciosa* is a morphologically and chromosomally variable Californian annual with nine pairs of chromosomes, found in the foothills bordering the San Joaquin Valley. Intraspecific hybridization has revealed that some groups of populations differ from others by six or seven reciprocal translocations. Within one morphologically uniform and geographically continuous subspecies we have obtained sterile hybrids forming single rings involving eight of the nine pairs of chromosomes at meiosis. The area of contact between these two chromosomal structural types is discussed, together with its possible evolutionary and taxonomic implications.

MOSSE, BARBARA. East Malling Research Station, England. *Experimental Techniques for Obtaining a Pure Inoculum of an Endogone sp., and Some Observations on the Vesicular-arbuscular Infections Caused by It.* Sporocarps and surface-sterilised resting spores of an *Endogone* sp. can cause vesicular-arbuscular mycorrhiza in a number of plants. Some evidence is presented of a relationship between plant growth, the formation of sporocarps, and the condition of resting spores within them. A method is described for the multiplication of sporocarps and for the regular germination of aseptic resting spores, that can provide a source of pure inoculum of this species. Some growth requirements of the *Endogone* sp. are discussed, and infections produced by it are compared with those produced by other vesicular-arbuscular endophytes. Some effects of mycorrhizal infection on the growth of plants in autoclaved soil, and of manurial treatments on the anatomical details of infection are briefly considered.

MOTHES, K. Deutsche Akademie der Wissenschaften, Halle, Germany. *Urea and Ureides.* Urea and ureides play an increasing role in the nitrogen nutrition of cultivated plants. The derivatives of urea appear in the metabolism of higher plants more frequently and in greater amounts than has been supposed till now. It is shown how far the uptake of urea is a non-osmotic or meta-osmotic process and to what degree urea can be submitted to chemical transformations without urease. The spontaneous and enzymatic reactions of urea with aldehyde acids are discussed. The transformation of the allantoic acid to allantoine and the possibility of the allantoine synthesis via purine are examined. Thus, the different pathways of the formation of urea (via purine-allantoine and via arginine) are demonstrated. The great importance of citrulline, δ-acetylornithine, and occasionally arginine as reserve substances and transport substances migrating in the xylem, as well as the relative rarity of ornithine, is discussed. The primary places of synthesis of the ureides and the reserve substances of the ornithine cycle are the roots, stems, and other storage organs. Carbamylphosphate can also transform amino groups non-enzymatically to ureide groups via its decomposition product cyanic acid. Guanidines and canavanine are more widespread than has been supposed; they also occur in leaves. Their accumulation and consumption are demonstrated.

MOTHES, K., and L. ENGELBRECHT. Deutche Akademie der Wissenschaften, Halle, Germany. *The Role of Kinetin in Accumulation Processes of Exised Leaves.* Under the influence of roots, exised tobacco leaves for a long time may show a continuous, straight-running protein accumulation and an almost stoichiometric increase in RNA and DNA without a division of the growing cells. In such materials kinetin does not promote cell division, even under optimal conditions for protein synthesis. If kinetin is sprayed on a limited area of unrooted leaves, this area not only remains green for a relatively long time (Richmond-Lang effect), but it primarily accumulates great quantities of soluble nitrogen compounds, especially mono-amino acids, aminocarboxylic acids, and their amides. Using isotopes, it is shown not only that there is an intralaminal migration of the endogenous soluble N to the kinetin locus, but that amino acids or ammonia salts applied either through the petiole or by spraying accumulate even in a short time in the kinetin-treated part. Protein synthesis, frequently but not necessarily, is the consequence of such an accumulation. This accumulation presupposes a migration against the gradient.

MOUNTAIN, W. B. Canada Department of Agriculture. *Studies on the Pathogenicity of Pratylenchus.* Necrosis of root tissue is the principal expression of susceptible plants to parasitism by *Pratylenchus*. The mechanism of nematode-induced necrosis in peach roots is discussed. There appears to be no evidence for resistance to *Pratylenchus* in tobacco or peach, but tolerance has been observed. The endoparasitic activities of *Pratylenchus* in roots of tolerant tobacco varieties or peach root stocks do not appear to differ from those in susceptible forms, but root necrosis is much reduced or absent in the former. Tolerance of peach root stocks to *Pratylenchus* appears to be inversely proportional to the concentration within the roots of the cyanophoric glucoside amygdalin.

MOYSE, A., M. L. CHAMPIGNY, et G. GIRAUD. Laboratoire de Photosynthèse du C.N.R.S., Gif-sur-Yvette, France. *Sur la répartition du C fixé par photosynthèse chez Rhodosorus marinus Geitler (Rhodophycée) en présence d'intensités lumineuses et de radiations diverses.* Les radiations vertes (527 ± 8 mμ) absorbées par la phycoérythrine sont 1,2 fois plus efficaces que les radiations rouges (679 ± 7) absorbées par la chlorophylle *a* et ces dernières sont 5 fois plus efficaces que les radiations bleues (438 ± 4), vis-à-vis de l'absorption de $^{14}CO_2$. La nature des radiations absorbées n'affecte pas la répartition du ^{14}C entre les différentes substances photosynthétisées lorsque la quantité de CO_2 fixé est la même. En présence de fortes quantités d'énergie, la synthèse des glucides est relativement beaucoup plus intense que celle des acides aminés. Cette dernière est relativement plus intense lorsque l'énergie est faible. La participation des oxydations est alors sensible, ainsi qu'en témoigne l'importance relative de la synthèse des acides glutamique et aspartique. Ces différences se maintiennent en absence ou en présence d'aliments azotés: NO_3K, urée. Cependant, la fixation est beaucoup plus abondante en présence d'urée qu'en présence des nitrates qui la dépriment.

MUNETA, JOAN, and ADRIAN M. SRB. Cornell University. *Paternal Transmission of Extra-chromosomal Properties in Neurospora.* Following acriflavine treatment of *Neurospora crassa*, a variant characterized by irregular but always slow growth has been isolated. In vegetative culture the variant has never reverted to wild type. In controlled crosses with wild type, the variant has been used both as conidial (paternal) and as protoperithecial (maternal) parent. Slow-growing variants do not appear among either of the reciprocal cross progenies. All products of individual meioses have been accounted for, and segregations of marker genes are normal. Back-crossing progeny cultures to the variant parent has not led to recovery of variants. A possible interpretation is that an extra-chromosomal property of wild type is transmitted to the progeny, both paternally and maternally, this property sufficing to repair the genetic defect of the variant. Results consistent with this interpretation are obtained when the variant is crossed reciprocally with *SG Neurospora*, a different variant whose mutant extra-chromosomal property is transmitted purely maternally in crosses with wild type. *SG* (protoperithecial) crossed by slow-growing variant (conidial) gives all *SG* progeny. The reciprocal cross yields some slow-growers but also *SG* and modified *SG* progeny. Therefore, at sexual reproduction protoperithecia of the slow-growing variant appear to accept extra-chromosomal properties provided by other strains.

MÜHLETHALER, K. Labor für Elektronenmikroskopie E.T.H., Zürich. *The Submicroscopic Structure of the Plant Cell.* Progress in cell biology is intimately connected with the development of new physical and chemical methods. Among the numerous new techniques, electron microscopy takes an important position, because it has enlarged our field of vision far beyond anything the ordinary microscope can detect. With this instrument new cell organelles have been discovered such as the endoplasmatic reticulum with its minute elements, the microsomes. In cell particles visible in the light microscope such as mitochondria and plastids, a complicated internal structure became visible. The detailed morphology of these organelles will be described in the following papers of this symposium. We shall see that the submicroscopic elements are fibres (cell walls), lamellae (plastids), tubules (mitochondria), or vesicles (endoplasmatic reticulum). At present the morphogenesis of these structures is not known in detail. However, there are many observations which indicate that common principles are involved in their formation. In mitochondria as well as in plastids, development begins by an invagination of the membrane of these particles. In this way tubules are formed which wind through the stroma. In mitochondria morphogenesis stops at this stage whilst in plastids it proceeds by a formation of minute vesicles at the ends of the tubuli. In a later stage of plastid development these vesicles, also composing the prolamellar body, merge together and form a lamellar structure. Similar morphogenetic processes can be observed during the formation of the endoplasmatic reticulum and the Golgi body. Among different species of the plant and animal kingdom, the structure and development of analogous cell organelles are more or less the same. If we compare the phylogenetic and ontogenetic development, we find that they are closely related.

MULLAHY, JOHN H. Loyola University of New Orleans. *The Algal Flora of the Chandaleur Islands of Louisiana.* Recent reviews of the algal vegetation of the Gulf of Mexico indicate that much remains to be done in this area. The Chandaleur Islands present an interesting ecological variation in the northern Gulf, and this is most manifest in the Phaeophycophyta and Rhodophycophyta found in this area.

MÜLLER, DETLEV. Copenhagen, Denmark. *On the Physiology of Tropical Rain Forest in Ivory Coast, Africa.* Dry matter production, leaf area, sun- and shade-leaves are discussed.

MÜLLER-STOLL, W. R., und W. HARTMANN. Botanisches Institut, Potsdam. *Vernalisationsphasen und Stoffwechselerscheinungen bei zweijährigen Pflanzen. Oenothera biennis* ist im Samenstadium nicht, im Jugendstadium (ca. 30 Tage) teilweise vernalisierbar und erreicht im Alter von etwa 56 Tagen ein erstes vernalisationsgünstiges Maximum. Es folgt eine Phase verminderter Vernalisationsfähigkeit durch Kälte, in der aber Behandlung mit Gibberillinsäure (GA) die Schosshemmung überwinden kann. Im Alter von ca. 180 Tagen wird ein zweites vernalisationsgünstiges Maximum erreicht; bei älteren Pflanzen nimmt die Vern.-Bereitschaft wieder ab. Wird im Zustand verringerter Vern.-Bereitschaft Schossen erzwungen, so erfolgt dieses nicht terminal, sondern durch Austrieb von Seitenknospen. Bei biennen Kulturpflanzen (Sorten von Beta und Brassica) ist die normale Phasenfolge durch züchterische Veränderung in Richtung auf Schossresistenz modifiziert. Bei Beta kann diese schon in sehr frühem Stadium durch GA überwunden werden, bei Brassica (Kopfkohl "Braunschweiger") war dies nicht möglich. Im Stoffwechselverhalten, besonders in der Aktivität von Peroxydase, Katalase und Phosphatase und teilweise auch in der Intensität der Respiration werden durch Kälte- und GA-Behandlung charakteristische Veränderungen hervorgerufen. Diese sind im einzelnen vom physiologischen Alter der Objekte und von der Behandlungsdauer abhängig und können noch 300 Tage nach Abschluss der Behandlung nachgewiesen werden. Die Stoffwechselreaktionen schossresistenter Kultursorten auf Kälte- und GA-Einwirkung sind sehr ähnlich wie bei Wildpflanzen und lassen darauf schliessen, dass es sich bei jenen nur um Modifikationen eines Reaktionsschemas von allgemeinerer Gültigkeit handelt.

MURDY, WILLIAM H. *See* ANDREWS, HENRY N., JR.

MURISON, W. F. *See* KRAJINA, VLADIMIR J., *et al.*

MURRAY, JAY C., and ADRIAN M. SRB. Cornell University. *A Recessive Gene Determining Colonial Growth of the Mycelium and Aberrant Asci in Neurospora crassa.* Two independent instances of mutation in *Neurospora crassa* have given rise to a mutant gene, *peak* (*pk*), that intervenes at different stages of the life cycle, affecting both the vegetative mycelium and parts of the fruiting structure. Mutant cultures are characterized by a highly compact aerial mycelium that takes the form of a peak. When two *peak* cultures are crossed with each other, the resulting perithecia contain only aberrant asci in which the spores have various arrangements but never the linear order that characterizes wild-type asci. No consistent genetic order has been found among the various aberrant arrangements of ascospores. When either *peak* strain has been crossed to wild type or to any of ten different morphological mutants, the resulting asci have always been of the kind typical of *N. crassa.* Since diploid nuclei heterozygous for the *pk* gene give rise to normal asci, but diploid nuclei homozygous for *pk* give rise to aberrant asci, the *pk* gene appears to be genetically recessive, and to represent one of the relatively rare instances in a basically monoploid organism where dominance relations can be determined by classical means.

MUZIK, T. J., and J. W. WHITWORTH. Washington State College. *Effect of Herbicides on Root Morphogenesis in Convolvulus arvensis.* Plants of two strains of bindweed (*Convolvulus arvensis*) differing in susceptibility to 2,4-dichlorophenoxyacetic acid (2,4-D) were grown in glass-faced boxes. The leaves were dipped or sprayed with various 2,4-D solutions and measurements of root growth and histological studies were made. The rate of elongation of roots on plants of the susceptible strain progressively decreased starting on the first day after the foliage was treated with 2,4-D (1,000 p.p.m.) until complete inhibition on the fourth day. Roots of the resistant strain followed a similar pattern except that complete inhibition did not occur until the sixth day, and the amount of growth after treatment was considerably greater. In one experiment, the inhibition of root growth occurred in roots six feet long within four to six days after the foliage was treated with 2,4-D. The inhibited root tips usually showed pronounced swelling in the region of the cortex just above the root cap. This was accompanied by excessive meristematic activity in the endodermal and pericycle regions near the apex resulting in a thick ring of tissue from the fusion of several lateral root primordia. Lateral root primordia were stimulated in number and size. In many regions of the older roots, ruptured and necrotic areas were associated with emergence of the new laterals on roots of the susceptible strain.

MYERS, J. *See* BISWAS, B. B.

MYTTENAERE, C. *See* RINGOET, A.

NAF, ULRICH. Rockefeller Institute for Medical Research, New York. *Genetic Tumors.* The account will deal with the tumors found on certain hybrids among species of the genus *Nicotiana*. A summary will be given of earlier work, beginning with Kostoff who first described the phenomenon. A classification of the parents of tumorous hybrids will then be presented which separates these parents into two groups, one called arbitrarily the plus-group, the other the minus-group. Only hybrids between plus- and minus-species are found to be tumorous. The feasibility of this classification shows that the critical contributions of minus-parents differ from those of plus-parents. The possible nature of these critical contributions is discussed. The classification is considered to be the basis of any attempt to explain tumor formation in the hybrid in terms of parental characteristics. Another section of the report will deal with the transition from normal to tumorous growth and with the role of the wound in the onset of tumorous growth.

NAF, ULRICH. Rockefeller Institute for Medical Research, New York. *On the Physiology of Antheridium Formation in Ferns.* An account will be given of a factor which controls antheridium formation in a majority of polypodiaceous ferns and in *Dicksonia punctilobula* (Dicksoniaceae). The factor was, however, found to be inactive toward *Osmunda claytoniana* (Osmundaceae), *Lygodium scandens,* and *Anemia phyllitidis* (Schizaeaceae). Two different factors controlling antheridium formation, one in *Lygodium scandens,* the other in *Anemia scandens,* could subsequently be demonstrated. Neither of these shows activity toward *Osmunda claytoniana.* The implications of these findings will be discussed.

NAGAI, R. *See* KAMIYA, N., *et al.*

NAKAYAMA, SHIDAI. Miyazaki University, Japan. *Effect of Certain Metabolic Inhibitors and Metabolites upon the Dark Process in the Photoperiodic Response of Pharbitis.* Azide, cyanide, fluoride, and arsenate prevent flowering in the dark period, but not in the light period (at least, cyanide and fluoridedo). All substances were applied by immersing a pair of cotyledons in aqueous solutions. Azide and cyanide are typical inhibitors of heavy metal-containing enzymes; the latter, moreover, is an inhibitor of 3-indoleacetic acid oxidase. On the other hand, azide and arsenate are uncouplers of oxidative phosphorylation. Inhibition of flowering by malonic acid could be observed only as compared with a control kept in air. It appears, therefore, that the dark process is closely related to respiration and to auxin metabolism. The inhibition of flowering by fluoride and a slight promotion of flowering by glucose suggest that the dark process is intimately connected with glycolytic processes and the given glucose may be utilized as substrate of the latter process. Kinetin given just before or during the inductive dark period promotes flowering considerably. This suggests that the dark process is related to desoxyribonucleic acid synthesis and protein metabolism in the cotyledon tissue.

NALBORCYK, E. *See* BIRECKA, HELENA, *et al.*

NANDA, K. K. *See* CHINOY, J. J.

NAPP-ZINN, KLAUS. Universität Köln. *Vernalization, Light, and Age with Special Regard to Arabidopsis thaliana.* Experiments with the winter-annual strain "Stockholm" of *Arabidopsis thaliana* had the following results. The vernalizability passes a minimum in plants at the age of approximately 45 days if they are grown at a low light intensity (200 w / m. ²) before and after vernalization. At a higher light intensity (550 w / m. ²), this minimum is already reached by seedlings not older than 7 days. Further experiments were carried out exclusively at the higher light intensity before and after vernalization. Weak illumination during vernalization (if compared with darkness) raises the vernalization effect only in plants less than 50 days old. After light vernalization, a heat treatment (4 days at 30° C., darkness) causes little or no devernalization. A small devernalizing effect may still be diminished by prolongation of the preceding cold treatment. After dark vernalization, only plants less than 40 days old (especially young seedlings) are largely devernalized by the treatment mentioned before. Its devernalizing effect in younger plants (seedlings) can be diminished by a stabilization treatment (e.g., 4 days at 20° C. under illumination, immediately after vernalization).

NAQVI, S. H. ZAMIN, and H. M. GOOD. University of Karachi, Pakistan, and Queen's University, Kingston, Ontario. *Studies of the Ageing of Conidia of Monilinia fructicola (Wint.) Honey.* Conidia of *Monilinia fructicola* (Wint.) Honey, were stored one to ten months at temperatures of 5°, 25°, and 35° C. and at constant relative humidities approximating 0, 15, 45, 75 and 90 per cent. The germination of these spores was tested on potato dextrose agar containing 6 per cent glucose. All spore samples gave 100 per cent germination after ten months. Storage in a relative humidity of 75 per cent gave the best preservation of spore vigor, there being evidence in other conditions of either high humidity or low humidity injury. A pronounced delay in germination developed under all conditions of storage. The rate at which this delay developed was virtually independent of the storage temperature. Storage under various temperatures and humidities caused all samples to lose weight steadily. The weight loss was more at high temperature (35° C.) and low humidity (10 per cent) and appeared largely due to water loss, though as much as 6 per cent of the fresh weight disappeared by respiration. The evidence obtained suggested that proteins make up a great part of the total respiratory substrate and the delay in germination of spores was probably due to the metabolism of proteins and free amino acids.

NATH, R., and W. B. MCCONNELL. National Research Council of Canada. *Utilization of Serine-C^{14} by Maturing Wheat Plant with Special Reference to the Incorporation in Glycine.* Serine-C^{14} (uniformly labeled) was injected into the top internode of wheat plant stems and the distribution of carbon-14 in the mature plants was studied. It was discovered that 56 per cent of the carbon-14 injected remained in the plants, only trace amounts of this occurring below the top internode. The kernels contained 48 per cent of the tracer injected, while only 4 per cent remained in the stem. Gluten had the highest specific activity of any major kernel component, serine and glycine accounting for much of the activity of this protein. The high specific activity of serine in gluten indicates its direct incorporation into kernel proteins. The specific activity of the glycine was almost equal to that of serine. Furthermore, since similar experiments with glycine-1-C^{14} had yielded gluten with highly radioactive serine-1-C^{14}, the ready interconvertibility of these two amino acids in the wheat plants is indicated. Probable modes of serine utilization are also discussed on the basis of labeling in sixteen amino acids, some of which were degraded to determine the localization of carbon-14 in their carbon skeletons.

NAVASHIN, MICHAEL S., and HELEN GERASSIMOVA-NAVASHINA. Academy of Sciences, Leningrad. *Fertilization and Events Leading up to Fertilization, and Their Bearing on the Origin of Angiosperms.* Cytological studies have shown that general laws of cellular life underlie the evolution of the process of reproduction. Therefore, the different types of embryo sac development should not be necessarily traced back to a single common prototype, the "normal type." On the other hand, it may be demonstrated that they could arise independently of each other since the type of development is found to depend not only on the inherent tendencies of the gametophyte itself but also on the variation in the ontogenesis of the reproductive organ surrounding it. The high reduction of the male gametophyte has resulted in a strictly intracellular habit of life of the sperms, the latter having lost motility. Cell mechanics, and mitotic activeness in the first place, thus became the principal source of forces operating in double fertilization. However, similar cytological principles can be shown to operate in more primitive plant groups, and elements of behaviour analogous to that found in angiosperms are accordingly discovered there. Double fertilization should not be considered, therefore, as a feature which could arise just once in the course of evolution. It seems more probable that it has evolved from elements the majority of which were already present in lower groups. Embryological evidence can thus be hardly regarded as supporting the view that angiosperms have arisen only once by a single step.

NEGISI, K. *See* SATOO, TAISITIROO

NEISH, A. C. Prairie Regional Laboratory, National Research Council. *Non-oxidative Interconversion of Monosaccharides.* A large number of enzymes are now known which catalyse the conversion of one monosaccharide to another. The usual substrates for these enzymes are the phosphate esters of the sugars or glycosidic derivatives such as nucleotides. The enzymes themselves can be classified into three groups: (1) enzymes which catalyse a reversible aldol-type carbon bond cleavage (e.g., aldolase); (2) enzymes which cause an apparent shift of hydrogen as in aldose $\rightleftharpoons$ ketose reactions (e.g., phosphohexose isomerase); and (3) enzymes catalysing a change in the configuration of an asymmetric center as in the uridinediphosphate glucose $\rightleftharpoons$ uridine diphosphate galactose reaction (e.g., galactowaldenase). During the past decade additional enzymes have been discovered in all of these classes, mainly as a result of investigations on respiration and photosynthesis. These enzymes catalyse reactions not involving any great change in free energy. Monosaccharides with three, four, five, six, or seven carbons can be formed without the necessity for any energy-yielding reactions such as oxidative decarboxylations. These monosaccharides may be used for the synthesis of glycosides, polysaccharides, or aromatic compounds.

NEISH, A. C. *See* WATKIN, J. E.; WIGHTMAN, F.

NELSON, C. D., H. J. PERKINS, and PAUL R. GORHAM. National Research Council of Canada. *Rapid Translocation of Photosynthetically Assimilated C^{14} out of the Primary Leaf of the Young Soybean Plant.* When the primary leaf of a soybean plant was allowed to carry on photosynthesis in $C^{14}O_2$, a small amount of labeled carbon was translocated downward into the root at a velocity of at least 2 cm. per sec. This velocity was 60 times greater than the velocity at which sucrose was translocated in the phloem. The rapidly translocated C^{14} was not moved as carbon dioxide. When the time of translocation was increased from 30 sec. to 10 min. there was an increase in C^{14} content of the root without any increase in C^{14} content of the hypocotyl. Autoradiography showed that the accumulation of C^{14} in the root occurred at certain sites. Part of the C^{14} was translocated through a steam-girdled stem, but under these conditions there was no accumulation in the root. This indicates that the rapid translocation of C^{14} occurred in both living and dead tissues of the stem. The significance of rapid translocation will be discussed.

NELSON, C. D. *See* CLAUSS, H., *et al.*

NELSON, P. E. *See* DROPKIN, VICTOR H.

NELSON, R. R. North Carolina State College and U.S. Department of Agriculture. *Evidence of a Complex Compatibility Locus in Cochliobolus heterostrophus.* Although sexual reproduction in *Cochliobolus heterostrophus* is governed by a number of separate gene loci, a single locus for compatibility accounts for the heterothallic behavior of the species. Studies on the evolution of heterothallism and its genetic basis suggest that the compatibility locus may be complex. Certain monoascosporic isolates produce normal-appearing sterile perithecia when selfed. From a cross of two wild-type isolates, a monoascosporic strain was obtained that when selfed produces perithecia with sterile asci. Studies demonstrate the isolates to be homocaryotic. These isolates possibly represent steps in a transition from heterothallism to homothallism. Four monoascosporic isolates that are self-sterile but fertile with both parental strains were obtained from a cross of an albino strain and a strain carrying a gene inhibiting formation of protoperithecia. The four strains are fertile with all isolates of one compatibility group, but are fertile only with the parental isolate of the other group, suggesting a genetic difference at the compatibility locus among isolates of the same compatibility group.

NEUFELD, E. F. *See* HASSID, W. Z., *et al.*

NEUSHUL, MICHAEL, JR. University of California. *Studies on Antarctic Marine Algae.* During the 1957–8 Argentine Antarctic Expedition collections of marine algae were made. Using a foam neoprene diving suit and self-contained underwater breathing apparatus, the author was able to observe and collect representative plants found growing as deep as sixty feet below the surface. Thirty-three dives were made along the Palmer Peninsula and in the South Shetland Islands. Preliminary morphological studies of several of the dominant brown algal components of the flora have yielded surprising results. The occurrence of unusual reproductive organs and developmental vegetative characters indicates the existence of plants that do not fit into the currently accepted brown algal taxonomic groups.

NEWCOMB, GENE B. University of California. *The Relationships of the Pines of Insular Baja California.* The relationships of the pines of Cedros Island and Guadalupe Island have been a problem of recurring interest since their discovery. The most recent taxonomic treatment placed the Cedros Island pine in *Pinus muricata* var. *cedrosensis* J. T. Howell and the Guadalupe Island pine in *P. radiata* var. *binata* (Engelm.) Lem. The basis for separation into two different species was primarily the number of resin canals in the leaf, reported as several per needle in the Cedros Island population and two per needle in the Guadalupe Island population. However, a thorough study of the foliar anatomy of the two pines has shown that the resin canal number varies from two to several in both populations, with a higher mean in that of Cedros Island. In addition, the morphology of the stomatal accessory cells is nearly identical in the two populations, while both differ from "typical" *P. radiata* and *P. muricata.* The cones of the two populations are also very similar. Those of Guadalupe Island, however, are more variable in the direction of mainland *P. radiata.* On the basis of the facts gained from this study, it is suggested that the two populations are more closely related than is indicated by their present nomenclatorial status. Probably the variation within the Guadalupe Island pine is due to introgression by *P. radiata* into a Cedros Island stock, while introgression of this same stock with *P. muricata* on the Channel Islands of "Alta" California has produced *P. remorata* H. L. Mason. Verification of these suggestions must await a long-range breeding program.

NEWMAN, DAVID W., and I. B. MCNULTY. University of Utah. *Fluoride Effects on Chloroplast Pigments.* Within the past few years increased attention has been given to the influence of fluorides on plant life. Several workers have reported a definite leaf chlorosis produced by water-soluble fluorides. In an attempt to elucidate the mechanism of fluoride-induced chlorosis, studies were made on the effect of fluorides on the chlorophylls and on some of the chlorophyll precursors. Leaf disks floating on a nutrient-fluoride solution showed a reduction in chlorophyll *a*, chlorophyll *b*, and protochlorophyll content compared to the leaf disks floating on nutrient only. A reduction in the leaf protochlorophyll content, induced by fluoride, was evident even before any reduction in chlorophyll *a* was noted. When the stems of bean plants were immersed in a sodium fluoride solution, a reduction in the leaf chlorophylls occurred. It appears that aqueous NaF causes a reduction in the chlorophyll synthesis mechanism. The water-soluble fluorides also caused a reduction in some of the other chloroplast pigments.

NICHIPOROVICH, A. A., and N. VOSKRESSENSKAYA. Academy of Sciences, Moscow. *Effect of Radiation of Various Wave Length Regions on Plant Composition.* The approximate constancy of the quantum yield of photosynthesis at various wave lengths indicates that a single fundamental photochemical reaction of photosynthesis is induced by photons of various wave lengths absorbed by chlorophyll. On the other hand, plants grown under light of various spectral compositions exhibit characteristic differences in many physiological and biochemical processes. An explanation of the latter fact may be the existence of additional photochemical reactions possessing action spectra differing from those of the fundamental photochemical reaction of photosynthesis. These reactions may be due to such photoactive substances as caratenoids, flavins, cytochromes, which may or may not be related to the functioning of the photosynthetic apparatus of the plants. Thus, in non-photosynthesizing organisms or organs and tissues of higher plants, the rate of respiration, protein synthesis, and other reactions can change under the action of light of different wave length. In photosynthetic organisms the auxiliary photochemical reactions may be directly related to the photosynthetic reaction cycle being an organic part of it and affecting the photosynthetic phosphorylation, nitrate reduction, and other processes. The ratio between the fundamental and auxiliary photochemical reactions of the process of photosynthesis depends on the composition of the light. This is one of the causes of the variation in the composition of the direct products of photosynthesis under the action of long- or short-wave light. As a result of prolonged action on the plants of light of various spectral composition, the presence of different reactions related and not related directly to photosynthesis leads to the appearance of many characteristic changes in the growth, development, metabolism and biochemical composition of the plants.

NICKELL, LOUIS G., and W. TULECKE. Chas. Pfizer & Co., Inc. Brooklyn, N.Y. *Submerged Growth of Different Types of Plant Tissue Cultures.* Nine selected plant tissue cultures are included: *Rosa* (stem), *Agave* (leaf), *Ilex* (root), *Ginkgo* (pollen), *Rumex* (root, virus tumor), *Helianthus* (petiole, crown gall), *Phaseolus* (hypocotyl), *Opuntia* (stem, crown gall), and *Lolium* (endosperm). A comparison is made of the growth rates, cell types, growth habits, and the response to several media and various environmental conditions. The differences observed as well as those which can be induced are discussed.

NICKELL, LOUIS G. *See* WEINSTEIN, LEONARD H., *et al.*

NICKERSON, WALTER J. Rutgers University, New Jersey. *Nutritional Control of Morphogenesis in Yeast-like Fungi.* That nutritional conditions can affect the form of growth of yeast-like organisms has long been known. Attempts to elucidate causal relations among nutritional factors, biochemical mediation, and form of growth are of more recent date. Reference will be made to studies on three different yeast-like organisms, in illustration of such attempts. The presence of a readily metabolizable carbon source tends to prevent filament formation and chlamydospore development in *Candida albicans*. Analysis of this effect revealed a biochemical linkage between carbohydrate metabolism and reduction of disulfide bonds. In turn, these findings led to recognition of the critical role of protein disulfide reductase in the cellular division process in yeasts (Nickerson and Falcone, 1956). In more recent studies (in collaboration with S. Bartnicki-Garcia), *Mucor rouxii* has been found to grow in a completely yeast-like form when incubated under very high carbon dioxide tensions. The effect of CO_2 tension on $^{14}CO_2$-fixation, enzymatic decarboxylations, and morphogenesis of *M. rouxii* will be discussed. During the past year, Dr. S. Senthe Shanmuganathan and I have been studying a so-called "triangular" yeast, *Trigonopsis variabilis*. It can be grown in a purely "ellipsoidal," or purely "triangular" form. The nutritional factor governing control of form is the availability of a methyl group donor. The relations of choline synthesis, phospholipid synthesis, and cellular form will be discussed.

NICKERSON, WALTER J. *See* BARTNICKI-GARCIA, S.

NIEDERHAUSER, JOHN S. Rockefeller Foundation. *Genetic Studies of Phytophthora infestans and Solanum Species in Relation to Late Blight Resistance in the*

Potato. A series of dominant, independently inherited genes conferring resistance to specific physiologic races of *Phytophthora infestans* has been found in *Solanum demissum.* Potato varieties with this dominant-gene resistance often become infected as new races of the pathogen appear. In the search for a more stable resistance, other *Solanum* species have been explored as sources of new resistance genes, and increased emphasis has been placed on the broader, multigenic resistance available in *S. demissum* and these other species. Where sexual recombination in *P. infestans* is absent or unknown, conflicting explanations have been advanced as to how new races arise. Whatever the mechanism, new races do appear when the *Solanum* genotypes are present to select for them. The nuclear history in the asexual stage is imperfectly understood, and the finding of a variable number of nuclei in single zoospores confuses the attempt to interpret results obtained with monozoosporic cultures. Where sexual oospores are functional, the potential number of physiologic races is perhaps unlimited. Crosses made between monozoosporic cultures have yielded, in the progeny, physiologic races different from either parent.

NIENSTAEDT, HANS. Northern Institute of Forest Genetics, Rhinelander, Wisconsin. *Induction of Early Flowering: A Critical Review of Recent Research.* Strangulation, ringing, phloem inversion, root pruning, and the application of fertilizer have been successfully used to stimulate flowering in older trees. In spite of claims to the contrary there is very little evidence that such treatments can induce juvenile trees to flower. Future work should distinguish more clearly between (1) flower stimulation in old trees which have reached the stage of readiness to flower and (2) flower induction in juvenile material. Both the size of the annual seed crop and the time at which the stage of readiness to flower is reached are the result of the combination of the endogenous conditions of the plant and the environment to which it is exposed from the time flower-inducing stimuli begin to form until the final seed dispersal. The endogenous conditions may include (1) genotype of the plant, (2) age – as it reflects the sum total of the environmental impact or the relative vigor of the plant or plant part; and (3) size – in terms of a "balance" of tissue; a balance, for example, of assimilating tissue to the total amount of meristimatic area, of root to top, of hormone-synthesizing tissue to hormone-utilizing tissue. This "balance" must have an influence on the metabolism of the plant and may ultimately determine its ability to produce flowers. An understanding of the role of the environment in flower induction is largely lacking. Photoperiod has been discounted in some recent studies of pine, but so far the evidence is insufficient to permit its effects to be disregarded. Temperature and general nutrition have a marked influence on ultimate seed yield, but their effects on flower primordia induction in trees are not known. Chemically, flower initiation seems to be controlled by a specific, rather complex, compound or compounds of a hormone-like nature; its true constitution is not known, as all attempts at isolation have failed. Studies of the chemical nature of flower induction, controlled studies of the environmental impact, and comparative studies of the gross morphological features of flowering and non-flowering plants or plant parts may be rewarding. They should evaluate responses in terms of flower – or perhaps flower primodia – production *per se* and not in terms of ultimate fruit or seed yield.

NITSCH, J. P. Laboratoire du Phytotron, Gif-sur-Yvette, France. *Les Auxines des fruits et leur mode d'action.* La croissance de certains fruits au moins est réglée par diverses substances de croissance. Les études chromatographiques de ces dernières années ont montré qu'on pouvait extraire des fruits (surtout des jeunes graines) plusieurs composés différents ayant les caractères d'auxines et de gibbérellines. La nature chimique exacte de la plupart de ces substances de croissance naturelle nous est encore inconnue. L'acide indole-3-acétique et son arabinoside, de même que la gibbérelline A_1 semblent cependant avoir été identifiés avec certitude. D'autre part, on a commencé à étudier l'effet produit par l'application de certaines auxines synthétiques sur l'équilibre interne des auxines se trouvant naturellement dans les fruits. On a également, et surtout grâce à des cultures *in vitro*, montré qu'il était possible de stimuler la prolifération des tissus de fruits par l'action conjuguée d'une auxine et d'un extrait complexe tel que le lait de coco. On a aussi confirmé l'existence, dans les fruits, de substances stimulant la division cellulaire. Enfin, quelques études récentes ont montré à nouveau combien le fruit, grâce aux hormones qu'il produit, réorganise à son profit le mouvement des substances nutritives dans la plante. Le rapport présenté fera le point de nos connaissances actuelles dans les différents aspects qui viennent d'être évoqués dans ce résumé.

NOBLES, MILDRED K. Canada Department of Agriculture. *Cultural Studies in Relation to Taxonomy and Phylogeny of the Polyporaceae.* Cultural studies of 252 species of the Polyporaceae have provided evidence that the family is composed of three groups: a primitive group consisting of species that produce no extracellular oxidase and, if heterothallic, show the bipolar type of interfertility; a more advanced group made up of species that produce extracellular oxidase and, if heterothallic, show the tetrapolar type of interfertility; and a small group of species that produce extracellular oxidase, have hyphae which are simple-septate in the advancing zone and nodose-septate elsewhere, and show the bipolar type of interfertility. Within these major groups, groups of species that are alike in hyphal and basidiospore characters appear to be related and it is suggested that they represent taxa of generic or higher rank. In the chart, these groups of species are arranged in order of the increasing complexity of their hyphal structures to form a sequence which may approximate their phylogeny.

NORDIN, VIDAR J. Canada Department of Agriculture. *Forest Disease Research Trends in Canada.* Forest disease research in Canada is carried out primarily as a federal government function by the Forest Biology Division, Research Branch, Department of Agriculture. The history of organization and research program will be reviewed from the time the first forest pathologist was appointed in 1920. The significance of native diseases in the management of Canadian forests is examined from the time of the initial emphasis on decay diseases to the present diversified program of disease surveys: ecology, biology, physiology, and taxonomy of fungi; nursery and plantation diseases; canker, die-back, and foliage diseases; mycorrhiza; decays; viruses; deterioration studies, particularly of timber injured or killed by insects, fire, and climate; physiogenic diseases; and the ecology, morphology, and physiology of trees. Forest disease research requirements in the foreseeable future are discussed.

NORRIS, RICHARD E. University of Minnesota. *Development of the Gonimoblast in Glaphyrymenia pustulosa J. Agardh.* The exact family relationship of *Glaphyrymenia* has not been firmly established. Using a fragment of the type specimen of the type species, *G. pustulosa,* it was shown (Norris, 1957) that this genus was a possible member of the Kallymeniaceae. A collection of fertile material made by the author from Elliston, South Australia, has made it possible to demonstrate the exact relationship of *Glaphyrymenia* in the Kallymeniaceae. *Glaphyrymenia pustulosa* produces a single carpogonial branch on a supporting cell that usually bears one to three subsidiary cells. A fusion cell is formed after fertilization from which several connecting filaments are produced. Auxiliary cells are the supporting cells of apparatuses similar to the carpogonial branch system, but without a carpogonial branch. After fusion of a connecting filament with an auxiliary cell, gonimoblast cells are produced. Carposporangia develop on the outer margins of the radiating gonimoblast filaments. In characters of reproduction and development of the gonimoblast, *Glaphyrymenia pustulosa* shows a close relationship to *Pugetia* and *Kallymenia.* The very narrow filaments of which the thallus is composed, in addition to the extreme gelatinous consistency of the thallus, are characters that seem to merit the maintenance of a separate genus. *Glaphyrymenia porphyroidea,* a species from South Africa, has been compared with the type species.

NOZAKI, M. *See* HORIO, T., *et al.*

ODUM, HOWARD T. Institute of Marine Science, Port Aransas, Texas. *Productivity of Tropical Vegetation.* Data from rain forests, reefs, marshes, deserts, and other tropical environments are presented in order to establish the magnitude of natural photosynthesis. Gross photosynthesis is at a generally high level, 5 to 40 gm./M^2/day, in rain forests, reefs, and other environments not strongly limited by the environment. Power outputs of gross photosynthesis are as large as in most agriculture and algal cultures with efficiencies of 5 per cent of visible light received. High yields are found both in water and on land. The low net yields in many tropical climax associations may be accounted for by the high levels of community respiration. The chlorophyll method for the assay of terrestrial as well as aquatic vegetation is illustrated with new data. Values range from 0.5 to 3.0 gm./M^2 in fully developed plant associations.

OGAWA, YUKIYOSHI. *See* IMAMURA, SHUN-ICHIRO, *et al.*

OGDEN, J. GORDON, III. Ohio Wesleyan University. *A Preliminary Study of the Vegetational and Climatic History of Little Round Lake, Ontario, by Means of Pollen Analysis.* A sediment core from Little Round Lake, Ontario (Lat. 44°47′30″ N, Long. 76°41′30″ W) includes 194 cm. of gyttja, 50 cm. of banded gyttja, and 642 cm. of homogeneous blue clay. A catastrophic change in sedimentation is indicated by a sharp transition from banded gyttja to blue clay at 246 cm. in the core. The clay sediments record a tundra-like vegetation which includes the pollen of grasses, sedges, and willows as well as the pollen of arctic or sub-arctic herbs. The sum of all tree pollen at each level in the clay does not exceed 35 per cent and consists principally of the pollen of pine, birch, and spruce. Fragmentation and etching of the pollen contained in the clay indicate that much of the pollen is redeposited. Pollen samples from above and below the banded gyttja/blue clay transition do not show a normal successional increase in forest cover. From stratigraphic and microfossil evidence it is concluded that plant succession leading to a closed boreal forest had taken place by the time the basin of Little Round Lake began to accept the local pollen rain. The clay sediments, and the pollen contained in the clay, are considered to be of preglacial origin. The sharp transition between inorganic and organic sedimentation indicates a sudden change in the source of the water entering Little Round Lake basin. A slight increase in shrub and herb pollen and a minimum of hemlock pollen at 160 cm. in the core may represent the climatic cooling which caused the Cochrane ice readvance to the north. The effects of forest clearance by colonists can be distinguished in the upper 10 cm. of the core.

OH-HAMA, T., S. MIYACHI, and H. TAMIYA. University of Tokyo and the Tokugawa Institute for Biological Research, Tokyo. *Change of Oxido-reductive Levels of Pyridine Nucleotides in thc Mechanism of Photosynthesis.* Using intact cells of *Chlorella*, quantitative measurements were made of the oxido-reductive levels of di- and triphosphopyridine nucleotide (DPN$^+$, DPNH, TPN$^+$, and TPNH) as well as of the concentration of the photogenic reducing agent (*R*) whose existence in green cells has been demonstrated by Calvin and Benson in their "pre-illumination experiment." It was found that there was no form of PN whose quantity was affected by various external conditions in the same manner as that of *R* which has been known to be produced only in the light and eliminated completely in the dark. A distinct effect of light upon the PN system was observed in the increase of TPN and decrease of DPN, indicating that the main photochemical event occurring in the PN system might be the conversion of DPN into TPN. When the algal cells were transferred from darkness to the light, gradual changes in the ratios TPNH/TPN$^+$ and DPNH/DPN$^+$ occurred, and the presence of CO_2 decreased the ratio of TPNH/TPN$^+$, but not of DPNH/DPN$^+$. These results suggest that, as a reducing agent functioning in the mechanism of photosynthesis, the photogenic agent *R* participates more primarily than the PN system, and that TPNH takes a more prominent part than DPNH.

OHTSUKI, T. Ochanomizu University, Tokyo. *Obligate Tonophily of a Mould which Grows on Glass.* In Japan, moulding of lenses and prisms of optical instruments such as microscopes, binoculars, and cameras very often occurs. The author has isolated a fungus, *Aspergillus glaucus* var. *tonophilus*, from mouldy lenses. Its cells were shown to have extremely high osmotic pressure. (1) It did not grow on media usually available. (2) It grew on media only when osmoactive substances, such as 8 to 20 per cent NaCl, were added. (3) When cultured two weeks on media with 9 per cent NaCl added, it was found that the freezing-point depression of the cell sap was –10.4, while that of the medium was –9.35. After incubation for 15 days, NaCl content of the medium rose to 12.5 per cent. When cultured a month on media containing 16.6 per cent NaCl, the freezing-point depression was –21(cell sap), –17.8(medium), of which the NaCl content became 24 per cent after incubation for 31 days. On the other hand, aerial germination on the glass surface under conditions of variously controlled moisture content was investigated. Results are as follows. (1) The fungus did not grow at 95 to 100 per cent R.H. (2) Under conditions of 60 to 90 per cent R.H., it generally grew; the range of R.H. which allows the germination depending upon the strain of the fungus. The relation between aerial germination and obligate tonophily of the mould will be discussed.

O'KELLEY, JOSEPH C. University of Alabama. *In vitro Pollen Germination and Tube Growth.* Pollen grains of many species of flowering plants germinate and pollen tubes elongate extensively in sugar solutions of appropriate osmotic pressure and pH when boron, as borate or tetraborate, in concentrations around 10 mg./liter, is added. A procedure for *in vitro* tests on pollen will be demonstrated. The necessity for the presence of added boron in some species and the influence of organic growth regulators and related materials on pollen germination and tube growth will also be demonstrated.

OKUNUKI, K. *See* HORIO, T., *et al.*

OLAH, LADISLAO V. Duquesne University, Pittsburgh. *Cytological Investigations in Rafflesia arnoldi R.Br.* A field expedition was carried out by the author in order to collect *Rafflesia* species in Sumatra, for cytological investigations. Several growing places (Padangtinggi, Kajuaro, Batang-Palupuh, Halaban on the volcano Gunnung Sago) were visited, and eleven buds, one flower, and a few fruits were collected. In one male bud, which was 14.5 cm. in diameter, the first haploid pollen grain mitosis was found. The chromosome number was determined as $n = 12$. The karyotype of the haploid complement of chromosomes was established, using Battaglia's system for the symbolic representation of karyotypes. The structure of the nuclei in tapetum cells, and a non-synchronized telophasic reconstruction of the daughter nuclei, found in pollen grains, were described. The onset of the meiotic division (leptotene) was found in a male bud which had a diameter of 13.7 cm., while pollen tetrads were observed in a bud which had a diameter of 15.8 cm. A morphological study was made on the buds, flower, and fruits. The material used in this study was identified as *Rafflesia arnoldi* R.Br.

OLIVE, L. S. *See* EL-ANI, ARIF S.

OLLAGNIER, M. *See* PREVOT, P.

OLSON, JERRY S. Oak Ridge National Laboratory, Tennessee. *Exponential Equations Relating Productivity, Decay, and Accumulation of Forest Litter.* Before we can predict the movement and possible hazards of radioactive isotopes in forests, we must estimate rates of accumulation and disintegration of leaf and twig litter. A simplified equation assuming (1) constant annual production of litter by a forest, and (2) negative exponential decay of this litter, implies accumulation of organic matter above mineral soil at a rate described by a half-time which equals the half-life for litter decay. Annual production and total mass of organic matter, near equilibrium, provide estimates of this half-time. Production and half-time provide convenient parameters for orderly comparison of widely scattered data on tropical, temperate, and northern forests. Graphs of predicted accumulation, for high, medium, and low values of both parameters, have interesting theoretical implications for ecological succession, climax, and net productivity of ecosystems.

OOTA, YUKITO, and K. TAKATA. Nagoya University, Japan. *The Role of Cytoplasmic Ribonucleoproteins.* The pH 7.1 fraction (obtained by treatment of the microsome fraction with a phosphate buffer, pH 7.1, 0.1 *M*) of either etiolated bean hypocotyls or cotyledons contains three electrophoretically separable components, I ($\mu = -6$), II (-10), and III (-12). Components I and II give strongly positive protein reaction (Folin-Ciocalteu reagent used), while component III is perfectly negative. By alkali digestion (0.5 N KOH, 37° C., 18 hrs.) all of the isolated components yield four nucleotides at essentially similar molar ratio: cytidylic/adenylic/guanylic/uridylic = 10/10/14/10 (assayed by Dowex-1-formate column chromatography). From the very beginning of germination, a step-wise ascent of mobilities of respective components of the degrading cotyledon microsomes apparently occurs; thus, in particular, a progressive change II → III → IV ($\mu = -14$) is noted. The same is also true for the hypocotyl samples at the latter half of "the germination stage" when the hypocotyl tissues tend by and large to be catabolic in their metabolic activity. These and other miscellaneous findings lead us to a working hypothesis that with the decay of protein-producing activity of the germ tissues free ribonucleic acid ("transportable RNA") may be liberated from microsomal ribonucleoprotein ("functional RNA") into soluble cytoplasm, which would migrate to actively growing tissues to be reconverted into "functional RNA." The generality of the hypothesis will also be considered in light of information available in the literature.

Oppenheimer, H. R. Hebrew University, Israel. *The Origin of Trifolium alexandrinum L.* The question of the origin of "Egyptian" clover, one of the principal forage crops of the subtropical zone, is controversial. Several plants have been considered as its ancestors: *T. constantinopolitanum* Séringe (Balkans, Anatolia, Syria), one of its ill-defined varieties (Boissier, 1872); *T. berytheum* Boiss. et Bl. (Lebanon; Trabut, 1910), and *T. apertum* Bobrov (Black Sea, Caucasus; Bobrov, 1945); not to mention species with a closed calyx, such as *T. squarrosum* L. A revision of the nearly related species *T. berytheum, I. apertum, I. vavilovi* Eig, and *I. carmeli* Boiss. has corroborated Trabut's view that *T. berytheum* is a wild variety of *T. alexandrinum*. *T. berytheum* is widespread on heavy, wet soils near the sea-coast of Israel. This corroborates Aaronsohn's assumption (1910) that *T. alexandrinum* grows wild in Palestine. Cultivated and wild varieties are not clearly distinguished morphologically. Cultivated *T. alexandrinum* originated—probably in historical times—by selection in natural pastures. Man isolated it from var. *berytheum* between Gaza and Beirut and possibly from other wild varieties growing in the inner valleys of Palestine and Syria. None of the other related species has been its "ancestor." Wild and cultivated types still coexist though there is so far no evidence of their interbreeding in Israel.

Ornduff, Robert. Reed College, Portland, Oregon. *Heterostyly in Jepsonia (Saxifragaceae).* Heterostyly is reported in the genus *Jepsonia* (Saxifragaceae), which consists of three species confined to small areas of California, adjacent Mexico, and offshore islands. Within a species, the flowers of one form are characterized by long styles, large stigmata with conspicuous papillae, short stamens, and small pollen grains. Flowers of the other form have short styles, small stigmata with inconspicuous papillae, long stamens, and large pollen grains. The only pollinations which result in a high seed set are those between these two forms; own-form pollinations result in a relatively small amount of seed. Heterostyly is unknown in other genera of the Saxifragaceae and the entire suborder Saxifragineae of the Rosales. Hence, in *Jepsonia*, it serves as a significant taxonomic character which reinforces other morphological features traditionally used to distinguish this genus from other related genera. While the strongly outbreeding system correlated with heterostyly would appear to be selectively advantageous under certain conditions, the distribution of the three species of *Jepsonia* indicates that they are rather narrow relictual endemics which were restricted to their present ranges during the Pleistocene. The occurrence of an insular endemic species of *Jepsonia* very close to mainland California suggests that self-incompatibility is disadvantageous to even short-range dispersal although ecological factors preventing migration may operate here as well.

OSBURN, WILLIAM S. University of Colorado. *Dynamics of Some Alpine Tundra Stands in the Colorado Rocky Mountains.* The *Kobresia bellardii* (All.) Degel meadow is the climatic climax vegetation in the alpine tundra on Niwot Ridge of the Colorado Front Range, but it is frequently absent because of the destructive activities of the pocket gopher (*Thommoys talpoides fossor*) and wind. The effect of these disturbing agents is to reduce or entirely eliminate the thick "A" soil horizon that is essential for the *Kobresia* meadow. Where gopher and wind action are in the process of reducing the amount of humus, an eroding soil surface with increasing amounts of gravel and dominance of plants with upright growth habit is formed. Upon cessation of gopher activity, when young, invading cushion-plants are no longer covered or eaten, a successional stand with a gravel soil surface and a preponderance of cushion plants is formed. When a sufficient depth of humus is developed, a *Kobresia* meadow replaces the cushion-plant stand. Further increase in the amount of humus does not produce further stand change. The major factor that operates directly on plant growth in this sere is soil water; the dynamic processes involved in the distribution of soil water control the plant composition of each stand.

OVERSTREET, ROY. University of California. *On the Nature of Ion Carriers in Mineral Absorption by Plants.* Ion accumulation in plant cells is thought to occur in two steps, (1) formation of a complex between the ion and a metabolically produced carrier on the exterior of the cell, and (2) chemical breakdown of the complex on the interior of the cell. The following specific interpretations of this very general idea are notable. (*a*) Various workers have emphasized the formal analogy between certain equations for ion transport and those for the action of an enzyme on a substrate. Also, when ion-absorption data are interpreted in terms of the theory of enzyme kinetics, numerous conclusions regarding the carrier substances emerge. In the author's opinion, however, this approach entails a number of hidden assumptions that have yet to be verified independently. (*b*) In certain quarters, it is thought that steps (1) and (2) are independent metabolic processes with differing behavior towards inhibitors. The attendant concepts of the carrier substances are discussed. (*c*) According to one group, steps (1) and (2) are but the summation of a series of separate processes. In consequence, a unique view of ion carriers is imposed. (*d*) Several investigators have postulated that ion carriers are intimately associated with the structure of cytoplasm. In the discussion of these postulates, the structural hypothesis of the author is elaborated.

OVINGTON, J. D. The Nature Conservancy, England, and University of Minnesota. *The Ecosystem Concept as an Aid to Forest Classification.* While remarkable advances have been made in devising and applying schemes of forest classification, the methods used are largely empirical and relatively little is known of the dynamic processes governing the relationships between site and the living organisms of the forest community. No practical system of forest classification could take into account all the diverse factors characteristic of forest ecosystems and it is suggested that detailed investigations of selected forest ecosystems would provide information essential to an understanding of the limitations and affinities of different classification schemes. Comparative data are given for two neighbouring stands of *Pseudostuga taxifolia* and *Alnus incana* planted on open heath to illustrate the changing nature of different forest communities both on a short- and long-term basis. Since the forest ecosystem is liable to change and forests are being increasingly restricted to sites which are inherently poor, there is a need to incorporate within the classification procedure some indication of the anticipated long-term changes that may affect future forest productivity.

OVINGTON, JOHN DERRICK. University of Minnesota. *The Productivity of Some British Woodlands.* During the last fifty years, extensive areas of Britain have been planted with monoculture stands of exotic tree species. This change in land use has often resulted in a marked increase of primary productivity and a dramatic change in the plant, soil, and atmosphere relationships. The rate at which organic matter is produced and accumulated by woodland communities depends upon various factors, but the potential ability of woodlands to utilise a site efficiently appears to result from their multi-layered structure which enables a huge leaf and root mass to be dispersed through a large air and soil volume respectively. Doubt has been expressed as to whether the high productivity of forest crops can be sustained indefinitely. Investigation of the long-term productivity of woodlands and the effects of woodlands on site factors must consider the dynamic relationships of the ecosystem as a whole.

OWENS, O. v. H. *See* KRALL, A. R.

OWNBEY, MARION. State College of Washington. *Genomic Segregation and Recombination in Species Hybrids.* The widespread occurrence of successful amphidiploid plant species indicates a structural rather than a genic basis for the sterility of many interspecific hybrids. Repatterning within single chromosomes ordinarily will not account for the sterility observed, but repatterning between chromosomes will do so. If deficient gametes are inviable, the maximum fertility is given by the formula $F = \frac{1}{2^{n-1}}$, where n is the number of chromosomes repatterned through progressive reciprocal translocation. Crossing-over may decrease this value, and if the chromosomes have differentiated genically as well as structurally, it may contribute to the variability of the parental species. The viable gametes will be reconstructed parental types with respect to their structural characteristics, and this is termed genomic segregation. Their random recombination in the F_2 will give a 1 : 2 : 1 ratio of reconstructed parent-like and F_1-like individuals. This accounts for the frequency of these classes in F_2 progenies. Cross-over segments will behave as Mendelian units within either of the parental populations, and subsequent crossing-over within a segment may give the appearance of gene mutation. This permits the genetic analysis of species differences and provides a simple mechanism for introgressive hybridization.

OZAKI, KIYOSHI. Shiga Agricultural College, Japan. *The Detection of Asparagine as a Criterion for Top-dressing for Rice in the Field.* The most suitable periods for the application of nitrogen fertilizers to rice growing in paddy soil in Japan are as follows: (1) application to the field just before the young plants are transplanted, (2) application of top-dressing during the period of vigorous vegetative growth; (3) application of top-dressing at the beginning of panicle formation. The top-dressing at panicle formation produces better growth of ears and higher yields of grain. However, if excessive amounts of nitrogen are applied at this period, the plants are weak and susceptible to mechanical injury, insect damage, and disease. For the most beneficial application of top-dressing, an accurate diagnosis of nitrogen in the plants is very important. In a series of investigations on nitrogen metabolism of the rice plant, the author found that asparagine content appears to parallel the increase of nitrogen in plant. For this reason it was thought that the detection of asparagine could serve as a good indicator for nitrogen content of rice plant. This has proven to be correct by field experiments and a simple rapid paperchromatographic method of asparagine detection for practical field use has been developed.

PACKER, JOHN G. University of Alberta. *Some Cytotaxonomic Observations on the Genus Chrysosplenium.* Three alternate-leaved *Chrysosplenium* species (section alternifolia) occur in Canada: *C. wrightii*, *C. iowense*, and *C. tetrandrum.* Current investigation has shown that *C. iowense* has a much wider distribution in Canada than has hitherto been supposed, having been confused in some instances with *C. tetrandrum.* Attention is drawn to the main morphological differences between the two species. The chromosome numbers have recently been determined and found to be: *C. tetrandrum*, $2n = 24$; *C. iowense*, $2n = 96$. A comparison by Hara (1949) revealed that *C. iowense* of North America was identical to the Asian *C. alternifolium* var. *sibiricum.* More recently (1957) Hara has referred to *C. alternifolium* and *C. alternifolium* var. *sibiricum* as being vicarious taxa. The cytological evidence suggests that this concept must be modified. *C. alternifolium* has a chromosome number of $2n = 48$ compared with $2n = 96$ for its supposed vicarious variety *sibiricum* (*C. iowense*). They are in fact false vicariads, in which *C. alternifolium* var. *sibiricum* should more correctly be given specific designation, the earliest legitimate name being *C. sibiricum.*

PADY, S. M., and C. L. KRAMER. Kansas State College. *Airborne Fungi in Kansas: A Two-year Study.* From September, 1956, to September, 1958, daily samples were taken on 404 days from the roof of a building on the Kansas State College campus. Studies included (1) fungus spores as obtained in a slit sampler, and (2) cultures from exposure of agar plates in a slit sampler and a GE electrostatic sampler. Numbers were calculated on a cubic foot basis. Streptomycin rose bengal (RBS) medium was used routinely, plus other media once weekly. Of 113,567 colonies examined, 82,911 were placed in 88 genera. Once weekly all colonies on RBS were subcultured and identified to species: 2,517 such colonies were identified and 168 species obtained. From the slides, fungus spores and hyphae were counted, 20 genera being identified. The fungi were found to be seasonal in distribution, highest numbers being found in the growing season (June-August); low numbers in the winter months. The commonest fungi were *Cladosporium*, comprising 44.5 per cent of the colonies and 40.9 per cent of the spores, *Alternaria* 12 and 3.4 per cent, *Penicillium* 6.1 per cent, and *Aspergillus* 5.4 per cent of the colonies. Of these genera four species of *Cladosporium*, three species of *Alternaria*, 35 species of *Penicillium*, and 23 species of *Aspergillus* were identified. Hyphal fragments were present throughout the year with numbers as high as 53 per cubic foot.

Page, O. T. Vining C. Dunlap Laboratories, Tela Railroad Co., La Lima, Honduras. *Variability in Fusarium oxysporum f. cubense (E.F.S.) Sny. & Hans. Fusarium* was isolated from diseased Gros Michel banana plants by removal of secondary wall thickenings together with adhering microflora from individual tracheary elements. Isolates were characterized with respect to pigment production, fusaric acid production, zinc tolerance, and by spectrophotometric and chromatographic analyses of culture filtrates. Mycelial, single-spore, and hyphal-tip transfers were used. By these and other techniques, *Fusarium* isolates from Gros Michel plants were circumscribed *in vitro* into groups. The validity of such groupings has been further investigated in preliminary genetic analyses.

Pageau, Gérard. Université de Montréal. *Système de classification des divers types de feuilles chez les plantes aquatiques supérieures.* L'importance fondamentale de la feuille dans la chaîne des fonctions du cycle vital de la plante, et la présence souvent de ce seul organe chez les nombreuses formes steriles des Hydrophytes, sont deux critères qui indiquent l'avantage et le besoin d'utiliser cet organe comme base d'une classification morphologique des plantes aquatiques. De plus, l'écologiste averti n'est pas sans remarquer le polymorphisme foliaire (polyphyllie) si accentué chez les Hydrophytes, et si bien demontré par la variation chez *Alisma gramineum* K.C. Gmel. C'est pourquoi le present système aligne en un spectre d'aquaticité relié à la forme de la feuille, dix types de base vg. Lemnoïde, Myriophylloïde, Scirpoïde, etc., qui peuvent être combinés, s'il y a lieu, pour donner la structure complète d'une espèce dans son amplitude de variabilité.

Palser, Barbara F. University of Chicago. *Some Aspects of Embryology in the Ericales.* Maheshwari lists twelve embryological features which are considered characteristic of Ericales. These include (1) endothecium absent in anthers, (2) ripe pollen in tetrads, (3) each microgametophyte two-celled, (4) ovules unitegmic with thin, ephemeral nucellus and endothelium, (5) megagametophyte monosporic and eight-nucleate, (6) endosperm cellular with first four cells linearly arranged, and (7) micropylar and chalazal endosperm haustoria. Some exceptions have been known and more found recently. (1) Clethraceae, Diapensiaceae, and *Enkyanthus* show an extensive, well-developed endothecium. (2) Single pollen grains occur in Clethraceae, Diapensiaceae, many Epacridaceae, Monotropoideae, *Pirola secunda, Erica stricta,* and *Enkyanthus.* (3) Three-celled ripe pollen occurs in one or more species of *Ampelothamnus, Andromeda, Arbutus, Cassiope, Chamaedaphne, Clethra, Comarostaphylis, Enkyanthus, Epigaea, Gaylussacia, Gaultheria, Leiophyllum, Lyonia, Pieris,* and *Vaccinium.* (4) Diapensiaceae have no endothelium. (5) Gametophytes of *Cassiope mertensiana* and *tetragona* are bisporic; antipodals in *Leucothoe racemosa, L. recurva,* and *Shortia galacifolia* are multiplied. (6) In *Rhododendron mucronatum* and *japonicum* walls form in endosperm only after a four-nucleate stage. (7) Endosperm haustoria are not found in Diapensiaceae. The structure and development of stamens, particularly of appendages and mechanism of dehiscence, are variable and should prove of considerable taxonomic value when worked out extensively. To date there are enough embryological data from

Ericales to indicate that variation exists but not enough to suggest its taxonomic application.

Pannier, Federico. Universidad Central, Caracas. *Comportamiento fisiológico de Podostemaceas en su ambiente natural.* Las Podostemáceas son plantas que crecen en los saltos y raudales de ríos tropicales. Por su extraño habitat y sus múltiples adaptaciones morfológicas para subsistir en corrientes de agua muy fuertes forman un grupo de plantas superiores aislado e fisiológicamente interesante. En el presente trabajo se estudian aspectos de su respiración y asimilación en su propio ambiente de vida. Este ambiente son los Saltos del Río Caroní, afluente del Orinoco (Guayana Venezolana). Ensayos con distintas saturaciones de oxígeno del agua muestran, que a elevadas saturaciones de oxígeno las plantas responden con un marcado aumento de la respiración. Asimismo, las distintas partes, submersas y emersas, de las plantas muestran valores respiratorios distintos. Los resultados demuestran su alta necesidad de oxígeno, lo que concuerda con el hecho de faltar en las plantas espacios intercelulares de almacenamiento. Los valores de asimilación medidos por el método de las variaciones del pH del medio, demuestran que las Podostemáceas estudiadas no utilizan el bicarbonato como fuente de carbono, sino que utilizan el CO_2 disuelto en el agua. El comportamiento de las Podostemáceas a pesar de su aspécto y hábito de plantas acuáticas, es por lo tanto el de plantas terrestres.

Papavizas, George C., and Charles B. Davey. Agricultural Research Service, U.S. Department of Agriculture. *Extent and Nature of the Rhizosphere of Lupinus.* To determine the extent of the rhizosphere of seedlings of *Lupinus angustifolius* a microsampler was built whereby serial soil microsamples 3 mm. in diameter could be obtained simultaneously from the surface of the roots outward to a distance of 21 mm. In unamended Elsinboro sandy loam the highest numbers of bacteria, streptomycetes, and fungi were obtained from soil closely adherent to root surfaces of 18-day-old seedlings and the lowest from soil most distant from the roots. From the surface of roots outward the "rhizosphere effect" was very pronounced to a distance of 3 mm. and was still evident at a distance of 18 mm. Quantitative and qualitative determinations of fungi at various distances from roots of healthy seedlings indicated that certain species were preferentially encouraged by the roots, whereas others were apparently unaffected. The effect depended on both the distance from root surface and the individual fungus species. In Elsinboro soil amended with finely ground, nitrogen-enriched organic residues, quantitative and qualitative changes in fungi were observed in the rhizosphere and at root surfaces of 25-day-old seedlings. The amendments reduced to less than unity the over-all rhizosphere/soil (R:S) ratios of fungi and the individual R:S ratios of most fungal genera.

Papenfuss, George F. University of California. *The Structure and Reproduction of Caloglossa leprieurii.* The development and structure of the thallus and the reproductive organs are described and the phylogenetic position of the genus is considered. The evidence at hand supports the conclusion of Kylin that *Caloglossa* is representative of a distinct group within the Delesseriaceae.

Park, R. B., N. Pon, A. Bassham, and M. Calvin. University of California. *CO_2 Fixation by Chloroplast and Steady State in vivo Systems.* Chloroplast systems have been used to investigate various aspects of the photosynthetic carbon cycle not readily studied with intact cells. A cytoplasmic fraction must be added to the isolated chloroplasts to obtain optimal CO_2 fixation. Metabolic interrelations observed in cell-free systems can be compared with those deduced on the basis of *in vivo* experiments. Improved physical arrangements for obtaining data on rate of labeling under steady state conditions with intact algae in a more complete nutritional environment have been devised. These improvements have permitted measurements of the relative rates of flow of carbon from the external system into the carbon reduction cycle and thence through a number of metabolites important to early phases of plant synthesis.

PARK, SANG SHIN. *See* LEE, MIN JAI, *et al.*

PARKE, MARY. Marine Biological Association, Plymouth, England. *Electron Microscope Observations on Scale-bearing Chrysophyceae.* Recent work with the electron microscope on the scales of many flagellate forms belonging to the Chrysophyceae has shown that great diversity of scale form can be encountered. The scale-bearing forms that have been studied so far (including unpublished data) are reviewed in relation to the number and type of flagella they produce and whether or not they are independent species or only motile phases in the life history of other forms. Certain of the forms with two flagella and a haptonema and with different types of scales have been shown by culturing to be motile phases in the life history of members of the Phaeocystaceae whilst others have been shown, again by culturing, to be the motile phases of members of the Coccolithophoridaceae. Evidence is also presented to show that two different types of scale structure can be developed in the life history of one member of the Coccolithophoridaceae, crystalloliths on the *Chrysochromulina*-type motile phase and placoliths on the *Coccolithus*-type non-motile phase. The importance of the Chrysophycean scales in taxonomy is discussed. The paper will present as much as possible of the electron microscope evidence in the form of lantern slides.

PARKER, JOHNSON. Yale University. *Desiccation Resistance of Cells and Organs and Its Quantitative Determination.* Some of the history of the idea of desiccation resistance of plant cells as opposed to the idea of water retention by cells and organs is reviewed and it is pointed out that both these factors probably play a role of some consequence in all land plants and perhaps also in intertidal marine algae. The importance of the condition of the vacuome to desiccation resistance is discussed and some ways of measuring its viscosity are described, including especially Brownian Movement, centrifugation of induced crystals, and micromanipulation. A possible advantage of an increase in viscosity of the vacuome is described which is related to the Iljin theory of mechanical rupture of the cytoplasm. The cytoplasm in most cells of the higher plants probably consists of several layers, and the apparent viscosity of one layer can be quite different from another. Methods of measuring the apparent viscosity are mentioned, including the plasmolysis time method, centrifugation, and others; some of the pitfalls in these methods are pointed out. Some methods of measuring desiccation resistance are enumerated. These include (1) direct measurements by subjecting whole organs or tissues to dehydration stress and after re-moistening, to determine viability, and (2) indirect methods including heat, cold, chemical, and radiation treatment, some of which have not been proven to be a measure of desiccation resistance.

PARKER, JOHNSON. Yale School of Forestry. *Seasonal Changes in Cold Hardiness of Eastern White Pine and the Relation to Physical and Sugar Changes.* From August until December the cold hardiness of leaves of three white pine trees increased in a step-like fashion with time, not in a smooth downward curve. By mid-December hardiness had increased to at least –75°C. using 3°/hr. rate of temperature change. Warming at 10°/hr., however, killed the leaves. Changes in the quantity of raffinose were closely related to changes in hardiness; sucrose also increased in winter, but monosaccharides (glucose and fructose) remained about the same. Physical changes in the chlorenchyma of the leaf and axial phloem parenchyma of bark included an increased viscosity of the vacuole so that in many there occurred a true gelation, an apparent tendency for the ectoplasm or part of the cytoplasm to become more fluid, and both a migration and an apparent fractionation of many chloroplasts in winter. Mercuric brom-phenol blue stain suggested an opening of protein chains in cytoplasm in winter.

PARODI, L. R. Universidad de Buenos Aires, Argentina. *Clasificacion de las Gramineas Argentinas basada en la morfologia, la cariologia y la anatomia foliar.* La finalidad de est a communicación es proponer una clasificación de las Gramineas argentinas en Subfamilias, y tribus tomando por base los caracteres florales, la estructura histologica foliar y el tamaño y número de los cromosomas. De esta manera las 28 tribus de Gramineas de la Argentina se las puede agrupar en las Subfamilias siguientes: (1) *Bambusoideae:* Bambuseae, Streptochaeteae, Olyreae, Phareae; (2) *Oryzoideae:* Oryzeae; (3) *Phragmitoideae:* Arundineae, Danthonieae, Ehrharteae, Unioleae; (4) *Festucoideae:* Stipeae, Festuceae, Aveneae, Phalarideae, Agrosteae, Hordeae, Monermeae; (5) *Eragrostoideae*: Eragrosteae, Chlorideae, Pappophoreae, Sporoboleae, Zoizieae, Aristideae (esta con estructura anatómica propia); (6) *Panicoideae:* Paniceae, Melinideae, Arthropogoneae, Andropogoneae, Maideae (Arundinelleae ? dudosas por falta de estudio anatom). En esta clasificacion las tribus de cada subfamilia presentan notable concordancia entre la anatomia, la cariologia, la morfologia y la distribucion geográfica. Las subfamilias *Bambusoideae, Oryzoideae, Eragrostoideae* y *Panicoideae* son tropicales o subtropicales, no pasan el 41°lat. Sur. Las *Phragmitoideae* tienen distribución tropical (*Gynerium*) y templada (*Cortaderia, Phragmites, Danthonia*). Las *Festucoideae* son mesotérmicas o microtérmicas; raras en las llanuras subtropicales, son frecuentes en las llanuras templadas y en los Andes desde el Ecuador hasta Tierra del Fuego donde habitan 100 especies, una de las cuales (*Deschampsia elegantula*) llega a la Antartida 64°S.

PARTANEN, CARL R. Children's Cancer Research Foundation, Boston. *Cytochemical and Nuclear Changes as a Reflection of the Process of Differentiation.* Polyploidization by means of endomitotic reduplication is a rather commonly observed phenomenon in many differentiated cells of the plant body. Similar nuclear behavior is a prominent feature of many tumors and plant tissue cultures. That such visible nuclear changes occur in cellular differentiation has been suggestive and has led to considerable speculation as to the possible relation between the two processes. An objective analysis of the situation must necessarily begin with a clear concept of differentiation. However, the multiplicity of phenomena included under that term precludes a simple definition. Taking a qualified, workable view of differentiation, one inescapably reaches the following conclusions. Polyploidy is not necessarily a concomitant of cellular differentiation; there are numerous cases of one without the other. Nor is it necessarily in any direct way causally related to other changes occurring in the same cell at the same time. In fact, somatic polyploidy can best be looked upon as a type of differentiation in itself, which may then serve to bring about, secondarily, other types of differentiation in the sense of creating physiological differences that may have various manifestations. But in this sense the causality need not necessarily depend upon the fact that the nucleus is also the bearer of the genes.

PARTANEN, CARL R. Children's Cancer Research Foundation, Boston. *Tumorization in the Gametophyte of the Fern Pteridium aquilinum.* Fern spores sown on simple agar media normally germinate to produce haploid gametophytes which bear antheridia and archegonia. Upon fertilization the diploid sporophytic generation is again initiated. In the absence of fertilization, however, gametophytes may be cultured indefinitely. Occasionally, tumorous abnormalities arise spontaneously in such gametophyte cultures. These tumors can be isolated and cultured indefinitely as tumors. They undergo a characteristic nuclear change from the original haploid condition to one of heterogeneity characterized by polyploidy, arrived at through endomitotic reduplication. The amounts of DNA in individual nuclei in gametophytes and in various stages of tumor reflect the observed chromosomal changes. Similar tumors can be produced experimentally in greatly increased numbers by exposing dormant spores to ionizing radiations before sowing. There is a linear relationship between the amount of radiation administered and the tumor frequency, as determined by quantitative techniques. Since the primary causal event to tumorization occurs in a single cell at a known time, and since the plants are grown on defined media, this system lends itself to an investigation of the biochemical bases of altered morphogenetic expression. Present results indicate that the tumor frequency can be reduced by adding amino acids to the medium. These and other findings suggest a basic involvement of nitrogen metabolism in this type of tumorization.

PATRICK, RUTH. Academy of Natural Sciences, Philadelphia. *An Evaluation of the Contribution to the Systematics of Diatoms of Electron Microscope Studies.* The principles of diatom classification were for the most part developed in the nineteenth century. The early systems of classification were based on manner of growth, color, and chloroplast formation. With the perfection of the lenses of the light microscope the system of classification was completely revised. The structure of the wall of the frustule and the markings on it became the basis of classification. The contribution of the electron microscope studies have been several. One, they have more firmly established the relationship of certain genera by more clearly showing the similarity of structure of diagnostic characters. On the species level, electron microscope studies have produced supporting evidence to establish similarities or differences of species which by light microscope studies could not firmly be established. They have greatly aided in the correct classification of species which have markings too fine to be resolved by the light microscope. To date, electron microscope studies of diatom structure have mainly served in clarifying the interpretation of structures based on resolution by the light microscope. They have not produced evidence which will bring about any serious revisions of our present system of classification.

PAWLOWSKI, BOGUMIL. Université Jagellonienne de Cracovie. *L'Origine de la flore montagnarde des Sudètes et des Carpathes.* La flore montagnarde vasculaire des Carpathes Occidentales compte 500 espèces plus ou moins, celle des Sudètes environ 200. L'endémisme est très bien marqué dans les Carpathes (Carpathes Orientales—plus de 80 espèces; Carpathes Occidentales—plus de 15; espèces endémiques générales des Carpathes—10 plus ou moins; plusieurs subendémiques). Il est très faible dans les Sudètes (quelques variétés et sousespèces, deux "species intermediae" du genre *Hieracium*). Carpathes et Sudètes: plusieurs plantes montagnardes sont originaires des Alpes; beaucoup moins de l'Asie Centrale et Orientale; très peu des pays arctiques. Carpathes (surtout Orientales): il y a plusieurs espèces dont l'origine est balkanique; plusieurs dont il est locale. Carpathes Orientales: il y a un bon nombre des survivants tertiaires, endémiques (exemple classique: *Syringa jasikaea*) ou d'une aire très disjointe (exemple: *Gentiana pyrenaica*). Carpathes Occidentales: il y a quelques endémiques d'âge tertiaire (*Dianthus nitidus, Delphinium exysepalum, Saxifraga perdurans, Daphne arbuscula*). Sudètes: il n'y a pas de survivants tertiaires. L'âge de la flore montagnarde ne dépasse pas l'époque glaciaire. Les Sudètes, montagnes très anciennes, étaient à l'époque tertiaire déjà probablement trop basses pour qu'il puisse s'y développer une flore d'orophytes capables de survivre la catastrophe climatique de l'époque glaciaire. Par contre, cela était possible dans les Carpathes, montagnes toutes jeunes, atteignant à l'époque tertiaire probablement son altitude maximale.

PEGG, G. F. Wye College, University of London. *Role of Indole-3-acetic Acid in the Development of Disease Symptoms in Verticillium Wilt of Tomato.* It has been shown using wheat and pea tissue bio-assays that culture filtrates of *Verticillium albo-atrum* possess marked growth-promoting activity. This activity was attributed to indole-3-acetic acid which was identified by colour test with Ehrlich's reagent on chromatograms of extracts of the filtrate. Bio-assays of stems and leaves from *Verticillium*-infected tomato plants showed increases in growth-promoting activity expressed as indole-3-acetic acid equivalents (IAAe) up to 200 per cent of those for the healthy controls. It is suggested that several symptoms of the *Verticillium* syndrome in tomato are attributable to growth substance activity, namely, petiolar epinasty, tylosis, pith hyperplasia and the formation of adventitious roots. Leafy tomato shoots placed in solutions of IAA (1.0 p.p.m.) developed tyloses after seven days. Serial sections of control and treated stems showed that there were more tyloses at the base than at the top of the shoot. More tyloses formed in older shoots than in younger ones. Epinasty and adventitious root development were induced in healthy shoots after treatment for seven days with solutions of IAA (0.01-10.0 p.p.m.). Treatment of stems with various concentrations of IAA failed to stimulate pith hyperplasia.

PERINA, V. Czechoslovak Academy of Agricultural Sciences. *Biological Amelioration of Soils under Pine Monocultures on Pleistocene Terraces of Central Europe.* Investigations in Czechoslovak pine stands of Querceto-Pinetum type on sand soils of Pleistocene terrace with inaccessible ground water show an accumulation of organic fall in the form of raw humus. The depth of raw humus increases with the age of the pine monocultures. The relation can be expressed by the formula: $y=0.1$, $x=1.89$, where y is the depth of raw humus, x, the age of the stand. The deepening layer of raw humus influences unfavourably the pedologic-biological, chemical, and hydrological qualities of soils. As a result, degradation of the soil profile occurs. Chemical improvement of these soils by means of limestone ($CaCO_3$) is short-term, the effects lasting not longer than 3 to 5 years. Even fertilization by means of basic rock meal gabbra acts only on a limited scale. The best effects have been achieved through biological amelioration by means of broad-leaved tree species, notably beech (*Fagus silvatica* L.) and basswood (*Tilia europeae* L.), and auxiliary cultures of *Lupinus perennis* L. This improvement was carried out in group cuttings in pine monocultures where microclimatic advantages have been utilized. The results of twenty years of experiments show that soil profile qualities in groups of broad-leaved tree species and lupines have been considerably improved. The improvement in upper horizons has occurred in the form of amelioration of mineralizing and humificating processes. Soils influenced by broad-leaved tree species show deeper humification of soil profile and in this way even the increasing of absolute soil humidity, notably in upper horizons. A total evaluation revealed that this means of biological improvement is very favourable and results in long-term effects. It therefore has been extended throughout Czechoslovakia to pine monocultures with the same site conditions.

PERKINS, H. J. *See* NELSON, C. D., *et al.*

PERRY, R. S. *See* TURRELL, F. M., *et al.*

PERRY, T. O. *See* WANG, CHI-WU

PETERSON, E. A. Microbiology Research Institute, Canada Department of Agriculture. *Seed-borne Fungi in Relation to Colonization of Roots.* As part of a study of the microflora developing on plant roots, analyses were made of the fungal populations of non-sterilized barley and flax seed and of their primary roots two days after seeding in natural soil and at short intervals thereafter over a period of three weeks. Results indicated that the fungi associated with the seed samples played little part in the colonization of roots in the soil. Species of *Aspergillus*, *Penicillium*, and *Alternaria*, abundant on the seed, were rarely obtained from root samples. The young roots (two days after seeding) were relatively free from fungi. However, those which were colonized at this time yielded species of *Pythium* and *Fusarium* predominantly. In subsequent samples the proportions of *Pythium* declined markedly, the predominating types being species of *Fusarium*, *Phoma*, *Pullularia*, and *Periconia*.

PETROV, M. P. Academy of Sciences of the Turkmenian S.S.R. *The Vegetation of the Deserts of Central Asia and the Regular Features in Its Distribution.* Comparison of Ordos, Ala-shan, and Pei-shan reveals the following principal regular features of the desert vegetation. The eastern desert regions of Central Asia are less arid than those in the west; consequently, the steppe elements are quite common among their vegetation. The aridity of the site conditions rapidly increases westward, which results in considerable impoverishment of the floristic composition of the deserts and in increasing sparsity of vegetative cover. The main dominant plants in the eastern deserts (Ordos) are semishrubs (*Artemisia ordosica, A. sphaerocephala*), whereas xeromorphic, gypsophitic, and halophytic shrubs and semishrubs (Nitraria, Reaumuria, Kalidium, Salsola, Sympegma, and others) prevail in the west. The frequent changes of plant associations and their complexity are very characteristic here. They depend on the complexity of the geomorphological structure of these deserts, the large number of soil types, and, accordingly, on various moisture conditions. The plant formations described represent a single zone of the desert vegetation in Central Asia. Within this zone it is impossible to distinguish any subzones, the plant formations being distributed in provinces, depending on the water, the soil, and the geomorphological conditions. In particular, the vegetations of the deserts of Ordos, Ala-shan, and Pei-shan, together with the northward extension of the latter two into the territory of the Mongolian People's Republic, namely the Ala-shan Gobi and the Trans-Altai Gobi, comprise virtually three independent geobotanical districts (the Ordos, the Ala-shan, the Pei-shan) clearly distinct with respect to floristic composition. The presence of mountain ranges in the deserts of Central Asia (Holan-shan, 3,230 m., Matsu-shan, 2,791 m., and others) results in the appearance of altitudinal belts of vegetation. The most abundant vegetation is found in the Holan-shan range, next to it is Matsu-shan. Both these ranges have a forest belt. From two to five belts: the desert, the desert-steppe, the scrub, the forest (composed of pine, spruce, and birch, with shrubby undergrowth) and the alpine belt may be represented, depending on the height of the range.

PETROVSKAYA, T. P. *See* PODDUBNAYA-ARNOLDI, V. A., *et al.*

PHILLIPS, EDWIN ALLEN. Pomona College and Claremont Graduate School. *Plant Moisture Measurements with the Delmhorst Moisture Detector Model PC-1.* Within the range 6 to 30 per cent and less accurately to 65 per cent, the moisture content of plant parts that are over an inch in length can be measured with a Delmhorst probe electrode, type 26E, sensitive at the tips only. This probe is useful for readings at the surface and by eighths of an inch to 1⅛ inches beneath. The probe is attached to a portable battery-operated meter from which the percentage of moisture is read directly. Corrections for temperature are provided in a table with the instrument. The meter was originally designed for testing the moisture content of lumber and a table indicates correction factors of less than 4 per cent for different species of wood. Sample readings are given, correlated with loss of weight methods for bark. Other readings are included for leaves, stems, and bryophyte clumps. Differences in rate of drying of different barks after rain and different amounts of penetration of rain into different barks have been measured. In general, readings are higher for pleurocarpous bryophytes than for acrocarpous bryophytes or hepatics, and greater on barks with bryophytes than on bare bark. For instance, studies at Big Basin State Park, California, indicate that when *Pseudoisothecium stoloniferum* clumps were measured on *Lithocarpua densiflora* (tan oak) the moisture content was 16 to 23 per cent and adjacent clumps of *Dendroalsia abietina* read 27 to 40 per cent. *Pseudoisothecium stoloniferum* readings were higher on adjacent *Sequoia sempervirens* (Coast redwood) (32 to 37 per cent) and on *Abies grandis* (lowland fir) (23 to 31 per cent). Measurements of bean and tomato stems, eucalyptus leaves, and agave and saguaro stems indicate consistent results when the probe is held by one person and the meter read by another.

PHILLIPS, E. W. J., and B. J. RENDLE. Forest Products Research Laboratory, Princes Risborough, England. *A New Approach to the Study of Density Variation in Wood.* Density is widely used as a convenient index of quality and is of special significance in current investigations aimed at improving timber quality by selection and breeding. It is usually determined on sizable specimens in which the wood substance may be distributed with varying degrees of uniformity depending on the characteristic anatomical pattern of the species and on the effects of age, environment, and genetic constitution. The technical properties of timber depend on the distribution as well as the amount of wood substance and the present paper deals with the development of a method of studying variation in both these features by means of density determination on a semi-micro scale using a collimated beam of beta particles from a strontium^{90} and yttrium^{90} source. A radial strip of wood prepared from an increment core is scanned in 0.5 mm. steps to show variation in density within individual rings. Comparative gravimetric determinations agree within 2.5 per cent. The method leads on to a new conception of the problem of measuring the proportion of late wood. Certain fundamental considerations underlying the method are discussed, as well as possible sources of error and suggestions for further refinement.

PICARD, MME CLAUDE. Laboratoire de Physiologie végétale de la Sorbonne. *Remarques sur l'action de l'acide gibbérellique sur Oenothera biennis L.* Les travaux de Lang sur la race bisannuelle de Jusquiame noire, ceux de Lona et ceux de Chouard effectués sur d'autres espèces ont montré que l'acide gibbérellique pouvait non seulement remplacer l'action du froid pour vernaliser certaines espèces, mais encore provoquer en jours courts la floraison de plantes de jours longs. C'est pourquoi nous avons voulu étudier les réactions d'*Oenothera biennis* L., plante bisannuelle vraie et héméropériodique absolue à des applications d'acide gibbérellique. Nous avons traité trois lots de plantes: les unes, préalablement vernalisées par un séjour approprié au froid ont été placées en jours courts, les autres, n'ayant jamais subi de réfrigération, ont été réparties en deux lots placés, l'un en jours courts, l'autre en jours longs. Au fur et à mesure des applications d'acide gibbérellique, les tiges des plantes traitées se sont allongées et la croissance des feuilles a été fortement stimulée, ces actions étant d'ailleurs plus intenses chez les plantes placées en jours longs. Mais nous n'avons, en aucun cas, observé de floraison, ce qui montre que l'action complètement vernalisante du froid naturel de l'hiver ne peut être que partiellement remplacée par des applications d'acide gibbérellique.

PIERCE, RICHARD L. *See* GRAYSON, JOHN F.

PINTNER, I. J., and L. PROVASOLI. Haskins Laboratories, New York. *The Nutrition of Volvox globator and V. tertius.* *Volvox globator* and *V. tertius* were generously supplied by E. George of Cambridge University who isolated them in bacteria-free culture. We confirm the results of Uspensky-Uspenskaya regarding the need of iron and the proportions of major elements. However, their source of iron (Fe citrate) precipitates easily in the alkaline media preferred by *Volvox.* The trace metals when chelated with ethylenediamine tetracetic acid or with hydroxyethylene diaminetriacetic acid do not precipitate and furnish an adequate supply, but small variations in pH cause toxicity and erratic results. A series of pH buffers was tried. Of the amines, tris (hydroxymethyl) aminomethane is the most inhibitory, while the inhibition caused by triethanolamine is almost completely removed by increasing the concentrations of calcium and magnesium. The best buffer for alkaline media is glycylglycine because it is more effective and is well tolerated. It may also act as an additional, and perhaps more physiological, metal-binder since it allows growth in a wider pH range. Calcium is the predominant ion: the optimal range is between 2-8 mg. per cent. Magnesium is needed at low concentrations and the best ratios of Ca/Mg are between 5:1 and 20:1. Tolerance to Mg is increased by increasing Ca, within the limits of acceptable total solids. The preferred N sources are nitrates and ammonium: the amino acids are poorly utilized, if at all. Both *Volvox* require Vitamin B_{12}. (The work was supported in part by Grant G-3216 of the National Institute of Health, U.S. Public Health Service.)

PIRSON, D. A. Pflanzenphysiol. Institut, Göttingen, Germany. *Observations in Synchronous Cultures of Chlorella.* It will be shown that in *Chlorella*, synchronized by regular light-dark changes, the life cycle is determined by an endogenous time factor. Within certain limits, the length of the life cycle is fairly independent of all factors which influence total substance production, for example, light intensity, length of the time of illumination, temperature, and external supply of sugar. On the other hand, these exogenous factors strongly influence the degree of synchronization, and particularly the number of daughter cells formed from one cell. With algae synchronized in this way, it must be considered carefully, whether an effect observed belongs to the life cycle proper or is primarily produced by the light-dark regime. As examples for true components of the life cycle the following will be mentioned: C/N relation, certain structural changes of the cell nuclei, and a transient sensibility against cold shocks. Conversely, an enhanced and fluctuating photosynthetic activity, observable in light- or dark-treated algae, depends on the influence of the external treatment more than on the life cycle itself. Maximal photosynthetic O_2 production in continuous light is limited by the speed of the reactions by which newly formed cell components are transformed to photosynthetically active material. This transformation seems to take place in the enzyme activity more than within the photochemical part of photosynthesis.

PITCHER, R. S. East Malling Research Station, Maidstone, England. *Nematodes as Primary Incitants of Root Rot Disease.* Root-attacking nematodes fall into two broad groups: the highly specialised sedentary species, such as the cyst-forming and root-knot nematodes; and the mobile polyphagous soil-migratory nematodes. The latter group consists mainly of ectoparasitic species, of many genera, which live in the rhizosphere and feed by inserting a stylet into the host root; but it also contains a few more specialised genera, such as the root-lesion and burrowing nematodes which freely enter the cortical root tissues to feed and lay eggs. Although all root-attacking nematodes are potential incitants of fungal and bacterial root rots, the root-lesion and burrowing nematodes are most frequently associated with field problems of this nature. Such problems are inevitably complex and as yet only partially understood. An attempt will be made to assess the present state of knowledge and the possible trend of future research.

Pocock, Mary Agard. Rhodes University, South Africa. *Two Little-known Species of Volvox, V. powersi and V. obversus.* Both species belong to that section of the genus *Volvox* where there are no inter-cellular protoplasmic strands. *Volvox powersi* is known only from Nebraska, where it is always found in muddy water. It is the least specialized but next to *V. gigas* is the largest species. Reproductive cells become differentiated after birth, the vegetative cells sometimes resuming division. Daughters are numerous, sometimes over 100. Sexual colonies are smaller than asexual; mixed asexual and female are common; male colonies are the smallest. Oospores are smooth walled. Spermatozoids occur 32 or 64 per platelet. *Volvox obversus*, described from the Philippines, is abundant in eastern Australia. Though it is one of the smallest species, it is highly specialized. Reproductive cells become differentiated at the 16-celled stage, the eight posterior cells ceasing to divide, the eight anterior cells dividing to form the many-celled colony. Gonidia number eight, and are large. At least one to four divisions occur in sexual colonies; posterior cells resume division. In the female colony, each divides once or twice giving 16 or 32 oogonidia; oospore with reticulate mesospore. In the male colony, each divides three or four times giving 64 or 128 androgonidia; spermatozoids number 128 per platelet. On germination biflagellate zoospores are formed, in *V. powersi* often more than one (two or four), in *V. obversus* usually one large one. The germ colony is small. Reproductive cells become differentiated at the 8-celled stage.

Poddubnaya-Arnoldi, V. A., and N. V. Zinger. Academy of Sciences, Moscow. *Application of Histochemical Technique to the Study of Embryonic Processes in Some Orchids.* Localization and dynamics of a number of plastic, physiologically active substances and enzymes were determined in the course of the development of the ovules and seeds of *Cypripedium insigne, Calanthe veitchii,* and *Dendrobium nobile.* The following results were obtained. A high peroxidase activity is found in the antipodes and suspensors, and, just before the fertilization, in the micropyle of the ovule. Cytochromeoxidase is also almost active in the antipodes and suspensors. The ovules and seeds of orchids are devoid of polyphenoloxidase. High dehydrase activity is typical of the micropylar zone of the embryo sac and of the developing embryo. Increased concentration of SH-groups is found in the antipodes and in the cells of the young embryo. Heteroauxin is almost lacking in the ovules and seeds of the orchids. Reserve polysaccharides, which are found in the orchid embryos and which in some species are represented in the form of starch and in others in the form of "brown polysaccharide" of an unknown nature, go with fat. Amino acids show a slight reaction. The proteins of the embryos of higher orchid forms do not show biuret reaction. Morpho-physiological insufficiency of the orchid embryos seems to be connected with their depressed oxidative processes, sluggish nitrogen metabolism, and reduced amount of heteroauxin and SH-groups.

Poddubnaya-Arnoldi, V. A., N. V. Zinger, T. P. Petrovskaya, and N. N. Polunina. Academy of Sciences, Moscow. *Histochemical Study of Pollen and Pollen Tubes in the Angiosperms.* Localization and dynamics of plastic, physiologically active substances and enzymes were studied in pollen and pollen tubes of 65 plant species belonging to 40 families. In various representatives of the angiosperms, the physiological processes occurring in pollen and pollen tubes have many features in common. The following ones were found: low peroxidase and cytochromeoxidase activity; lack of polyphenoloxidase; comparatively high activity of catalase, dehydrase, and acid phosphatase; the presence of proteins, amino and nucleic acids, fats, SH-groups, inorganic phosphorus, pectins, and cellulose in all species under study, though of different concentration; the presence of starch, sugars, ascorbic acid, and hetero-auxin in many of the species. With the elongation of the pollen tubes the greatest amount of substances becomes localized in the tip of the pollen tube which shows its high physiological activity. The pollen even in one and the same anther usually shows reactions of different intensity. This proves physiological heterogeneity of pollen. In the presence of morphologically heterogeneous pollen (e.g., in hybrids and polyploids), the differences in the degree of the reaction intensity are still more distinct. Histochemical study of pollen and pollen tubes shows them to be an entire active system functioning from the moment of pollen emergence up to the act of fertilization.

POLAVYANYUK, A. F. *See* KONAREV, V. G., *et al.*

POLITIS, JEAN. Académie d'Athènes. *Recherches cytologiques sur la formation de l'acide chlorogénique chez les Ombellifères.* Dans le but d'essayer de résoudre la question du processus cytologique par lequel l'acide chlorogénique apparait dans les cellules des plantes de la famille des Ombellifères, nous avons examiné les espèces suivantes: *Apium graveolens* L., *Bupleurum rotundifolium* L., *Bifora radicans* Bieb, *Angelica archangelica* L., *Orlaya grandiflora* Hoffm. Dans la feuille de *Apium graveolens* L., l'acide chlorogénique se recontre dans les cellules de l'épiderme supérieur, dans les cellules de l'épiderme inférieur, et dans le tissu palissadique. Chacune de ces cellules, à un stade très précoce du développement, contient, outre le noyau et les plastes, un très petit corps sphérique qui grossit peu à peu et devient plus grand que le noyau. Parfois ce corpuscule présente à sa surface des excroissances sphériques. Ces corps présentent les caractères microchemiques de l'acide chlorogénique et se colorent vitalement en bleu de méthylène. Nous avons aussi examiné la production de l'acide chlorogénique au cours de la croissance des cellules de jeunes racines. Pour obtenir une coloration vitale du point végétatif, il faut détacher le sommet du meristème et le plonger dans une solution très diluée de bleu de méthylène. L'examen des feuilles d'autres Ombellifères nous a fourni des resultats analogues.

POLLACK, BRUCE M. University of Delaware. *Anatomical Localization of Physiological Processes in Seed Germination.* The seed occupies a unique position in botany in that, as the basis for our food supply, it is of great economic importance. At the same time, it is of fundamental importance as a tool in plant physiology because most of the known physiological processes are concentrated in the growth and development of this small unit. Thus the seed is the nearest thing the plant physiologist has to an "isolated system." The seed cannot, however, be considered to be a homogeneous system, even though it is frequently treated as such. Instead, it has a high degree of internal organization, both anatomical and physiological. Catabolic processes concerned with nutrient supply are localized in the cotyledons and/or endosperm which constitute the bulk of the seed; anabolic processes associated with synthesis and growth are localized in the very small embryonic axis. Since methods are available to make it feasible to work with the amounts of material present in the embryonic axis, much more effort should be made to study the localization of processes within the seed. Specific examples of this approach as applied to the study of the rest period and germination in cherry seeds (*Prunus cerasus* L.) are cited, and fundamental questions regarding the relationship between the parts of the seed are raised.

POLLACK, J. D., and M. SILVA. Columbia University. *Effect of Casein and Amino Acids on the Sporulation and Growth of Normal and Pleomorphic Variants of Epidermophyton floccosum.* Following the observation that casein hydrolysate induced abundant sporulation in two pleomorphic variants of *Epidermophyton floccosum,* amino acids were tested as the possible inducers. Initially, 19 amino acids were tested, combined in the same concentrations as in the casein medium but omitting one at a time. One of the two variants sporulated abundantly when isoleucine, aspartic acid, and proline were omitted; no sporulation was observed in either variant when glycine, phenylalanine, tyrosine, threonine, cysteine, and arginine were omitted. Groups of apparently spore-stimulating, inhibiting, inert, and an additional arbitrary selection of amino acids were tested singly and in all possible combinations. Sporulation of one variant followed the expected pattern. Finally, 23 amino acids were tested individually at three different concentrations for their effect on the colony and microscopic characters of this pleomorphic variant and its wild-type precursor. The intermediate concentration was also tested with 0.2 per cent asparagine. Some amino acids affected growth linearly and also the reversal to a non-pleomorphic colony morphology. Others induced maximal sporulation at a critical concentration. These nutritionally induced effects, besides helping identify pleomorphic variants, reopen the old question: is pleomorphism in the dermatophytes reversible by environmental changes?

POLLACK, J. D. *See* SILVA, MARGARITA

POLLACK, ROBERT L., and CLAUDE H. HILLS. U.S. Department of Agriculture. *The Respiratory Activity of the Red Tart Cherry during Growth.* Changes in the respiratory activity of the red tart cherry were determined at all stages of growth up to complete maturity for several successive seasons. The respiratory activities of the fruit followed a similar pattern for each year. The highest exchange of oxygen and carbon dioxide—a rate of 300-400 μl. per gram of whole fresh tissue per hour—took place at the earliest stages when the tiny cherries resembled green peas. From this peak the gas exchange kept decreasing in amount until it leveled off to approximately 50 μl./gm./hr. No evidence of a climacteric rise in the respiratory rate, such as has been noted in apples and other fruits, has been found in cherries. The respiratory activity determined for five days following the removal of the fruit from the tree also failed to reveal any significant climacteric change.

POLUNINA, N. N. *See* PODDUBNAYA ARNOLDI, V. A., *et al.*

PON, N. *See* PARK, R. B., *et al.*

Pond, Virginia. *See* Sparrow, Arnold H., *et al.*

Ponniah, Stella. A.I.R. Station, Tiruchirapalli, India, *On the effect of Recorded Musical Sound Waves of Flute on the Growth of Pothos.* Quite a good deal of work has been done by the Annamalai School of Botany during the past eight years on the growth of plants under musical sound excitations produced *originally* from various musical stringed and wind instruments; but there has been no work on similar lines with *recorded* musical sounds. Results of studies in this line have therefore been presented in this paper. An Indo-Malayan ornamental plant *Pothos* (Araceae) was chosen for the experiment because it can be readily raised from clones and is at the same time very handy and could be grown indoors in shade. The recorded musical sound chosen for excitation was *Kamboji Raga* (Karnatik Music) played on the flute by the renowned Indian flautist, Shri T. R. Mahalingam of Bangalore. Plants of *Pothos* of equal vigour and height were excited by the recorded flute music through a gramophone, between the hours of 17.00 and 18.00 in the evening daily for 30 minutes for a continuous period of 30 days. The same number of *Pothos* plants of almost the same vigour and height was maintained separately as control. As a result, it has been found that the average height of plants has increased by 25 per cent, average number of roots by 100 per cent, average number of leaves 50 per cent and average length × breadth of leaves by 30 per cent over those of the control plants.

Pop, Emil. Universitatea Victor Babes, Cluj, Roumania. *Recherches statistiques et expérimentales concernant les courants protoplasmiques.* Une recherche statistique entreprise chez tous les types cellulaires et dans toutes les étapes de développement des 100 espèces de Labiées mènent vers la conclusion que la dinèse est un phénomène citophysiologique générale et primaire. Elle nous indique en même temps les facteurs internes qui peuvent empêcher la dinèse. Une condition fondamentale pour le déclanchement de la dinèse est l'état d'extension du protoplasme. Dans le mesure ou le protoplasme normal est tendu, dans cette même mesure la dinèse est relativement plus intense. L'affirmation a été vérifiée expérimentalement chez les cellules de la zone de croissance, chez les poils radicaux dans diverses étapes de développement, chez les cordons plasmatiques intravacuolaires comparativement au plasma pariétal, chez la plasmolyse concave entre le plasma tendu ou bien contracté. Le fait que ce n'est pas la présence de la vacuole, mais que c'est, au contraire, l'état physique d'extension du plasma qui est la condition de la dinèse, a été démontré dans le cas de certains poils plus âgés avec la vacuole devenue petite et située au pôle de la cellule.

Popova, O. F. *See* Sapozhnikov, D. I., *et al.*

Porter, William L., and Kenneth V. Thimann. Harvard University. *Molecular and Functional Complementarity of Auxins and Phosphatides.* Evidence is presented that the minimum molecular requirements for primary auxin action are: (1) a potential anionic negatively charged atom, (2) an atom with pronounced fractional or full formal positive charge at an unobstructed distance of about 5½ units from the anion on a relatively planar surface, (3) a lipophilic group, co-planar with the positively charged atom and in one of three possible orientations dependent on side-chain length. The theory proposed explains the favorable influence of chlorination but the inactivity of 3,5-D, of 2,4,6-T and of 2,4,6-trichlorobenzoic acid, the effects of optical and geometric isomerism, and the contrast between these effects in different ring systems, as well as the general inactivity of saturated rings. This structure could complement that of a phosphatide molecule, the auxin anion being attracted to the phosphatide nitrogen and the precise orientation being imposed by attraction of the positive charge to the phosphatide anion. An interpretation of the relation between cell enlargement and this postulated association between auxin and phosphatides will be offered. In some respects this concept is related to the ideas suggested by Bennet-Clark and Veldstra.

Posnette, A. F. *See* Kassanis, B.

Potonié, Robert. Geologisches Landesamt Nordrhein-Westfalen, Krefeld, Germany. *The Type Method: A Palaeobotanical Technique for Exact Stratigraphy.* Palaeobotany furnishes the time relation between the different taxonomic parts of plants. The approach to this time relation can be clearly designated only when we know the stratigraphic *locus typicus* of the taxon from its nomenclatural type and not from specimens added later. Thus, the type method must be observed not only for nomenclatural priority, but also for stratigraphic *locus typicus.* Fossil plants are found mostly as specimens of detached "organs" on which the names of species are based. Therefore, initially, stratigraphy is based on correlation of nomenclatural types of such organs. Because it is commonly not possible to prove relationship between these organs, and also because plant parts have different diagnostic value, they have peculiar stratigraphic value. In given plants, one organ is more specialized than the others. The latter may resemble those of other species or even of other genera and families. Thus, in stratigraphy, we are prevented from immediately following establishments of connection between different organs, but must continue to work independently with each stratigraphic *locus typicus* of the nomenclatural types of all the detached organs. Placing an organ with a more differentiated one often causes stratigraphic confusion. Different organs have different stratigraphic value.

Povilaitis, Bronius. Canada Department of Agriculture, Tobacco Substation, Delhi, Ontario. *Alterations in Leaf Tissue of Flue-cured Tobacco, Nicotiana tabacum, Induced by Weather Fleck.* Weather fleck of flue-cured tobacco, supposedly a physiological disorder of the plant, was studied microscopically in 1958. A few hours after the appearance of the fleck only the palisade layer was affected. Alterations in the spongy mesophyll were observed only in somewhat older flecks. The nuclei of the palisade cells of the fleck had shrunk considerably. Their average dimensions were found to be 6.5 × 4.9 microns as compared to 10.3 × 6.6 microns in adjacent non-flecked areas of the same leaf. The volume of nuclei in flecked areas was probably comparable to that in non-flecked areas; however, the nuclei in flecked areas were found to be more or less spherical and they also showed pycnotic staining properties. There was practically no difference in the size of the chloroplasts between the flecked and non-flecked areas of the palisade layer. In some flecks only a small proportion of chloroplasts showed apparently unchanged outlines, the rest were partially or completely absorbed.

Póvoa dos Reis, M. Universidade de Coimbra, Portugal. *Variabilidade do tricogínio no género Batrachospermum Roth.* Os autores que se têm occupado do género *Batrachospermum* Roth têm dado especial relevo à forma do *tricogínio* para estabelecimento das secções. Assim: A secção *Turficola* compreende espécies de *tricogínio troncónico inverso;* A secção *Helminthoidea* é caracterizada por um *tricogínio ovóide ou elipsóide;* A secção *Contorta* tem como espécie tipo *B. procarpum* Skuja, cujo *tricogínio* é a princípio *troncónico inverso* e mais tarde *claviforme.* Hoje verifica-se que as duas primeiras secções acima referidas compreendem também espécies cujo *tricogínio* apresenta a forma *cilindróide séssil.* Na secção *Contorta, B. gracillimum* (W. et S. S. West) Skuja possui *tricogínio cilindróide séssil,* diferente, portanto, do encontrado em *B. procarpum* Skuja. Dada esta variabilidade, concluímos que a forma do tricogínio deverá ser considerada carácter secundário no estabelecimento das secções do género.

Powell, John M. *See* Soper, James H.

Powers, H. R., Jr., J. G. Moseman, and W. J. Sando. U.S. Department of Agriculture. *Genetic Basis of the Host-parasite Relationship of Wheat and Barley Powdery Mildew.* Genetic interactions involving host and parasite in powdery mildew of wheat and barley were investigated. Specific genes for reaction to mildew were studied in each host. The pathogens, *Erysiphe graminis* f. sp. *tritici* and *E. graminis* f. sp. *hordei,* are heterothallic and, therefore, it was possible to cross cultures which gave differential reactions on their respective hosts. This permitted the investigation of the genetic basis of pathogenicity in the parasite. It was found that for each gene pair conditioning reaction in the host there was a complementary gene conditioning pathogenicity in the parasite. A suspectible-type infection resulted from any one of the following combinations of complementary genes for pathogenicity in the parasite and for reaction in the host, respectively: virulence and susceptibility, virulence and resistance, or avirulence and susceptibility. A resistant-type infection resulted only from a combination of a gene conditioning avirulence in the pathogen and a complementary gene conditioning resistance in the host. This resistant reaction was expressed regardless of any other combination of genes in the organism and host which would have otherwise produced a more susceptible-type infection. Cultures of the parasite with known pathogenic genotypes were utilized in the detection and identification of genes conditioning response in the host.

Pramer, David. Rutgers—The State University, New Jersey. *Antibiotics.* Antibiotics are a group of organic compounds distinguished by their selective toxicity to micro-organisms and by their method of manufacture. They appeared on the commercial market at approximately the same time that systemic herbicides and systemic insecticides were introducing a new concept into the field of agricultural chemicals. No attempt will be made to survey all studies relating to the effectiveness of antibiotics as substances for the systemic control of plant diseases. Instead, selected topics having fundamental and applied implications will be reviewed. The antimicrobial spectra and phytotoxicity of antibiotics will be considered. The absorption and translocation of antibiotics by higher plants will be discussed in detail and our present knowledge of the mode of action of antibiotics in plant disease control will be summarized. The review will clarify the present status of antibiotics in the field of plant pathology. Patterns apparent in the results surveyed will be generalized to provide principles that may prove of value in guiding future investigations.

Prat, Henri. Université de Montréal. *Demonstration d'une méthode d'étude de la thermogenèse végétale au moyen de micro-calorimètres Calvet à enregistrement continu.* Cette démonstration sera faite à l'Université de Montréal, salle A615, dans notre laboratoire de micro-calorimétrie biologique. (Les appareils ne peuvent pas être transportés.) Elle comportera la présentation des appareils utilisés, d'un certain nombre d'enregistrements et l'exécution de mesures de thermogenése sur matérial végétal: grains en germination, tiges en croissance, etc.

Prat, Henri. Université de Montréal. *Emploi des caractères épidermiques dans la classification des graminées.* Les grandes divisions (sous familles ou groupes de tribus) peuvent être distinguées par des caractères de structure des éléments épidermiques: présence ou absence de poils bicellulaires, types des cellules siliceuses, etc. Les genres et espèces peuvent l'être par des caractères de répartition de ces éléments. Ces caractères coïncident avec ceux qui fournissent l'anatomie, la karyologie, l'embryologie, la physiologie, la biogéographie, pour permettre de rectifier la position systématique de certains genres au sein des tribus. Ils présentent l'avantage de pouvoir être observés sur de petits fragments.

Prát, S. Charles University, Prague. *The Effect of Humus Substances on Plants.* In contrast to their considerable effect on growth, humus substances have only a negligible influence on callusing, and the regeneration of buds on the roots as well as rooting from intact stems. The stimulating effect of humus substances on growth is of a different kind than the influence of growth factors (heteroauxins). The strongly increased guttation proves the effect of humates on water transport. The chlorophyll and carotenoid content is increased in cultures with humates. The respiration intensity of wheat roots is increased by humates. Wheat roots cultivated with humates have the same qualitative composition of glycides (fructosans, raffinose, saccharose, glucose, fructose, ribose, and the "N" glycide were chromatographically determined), and amino acids; but their mutual relations are altered. By a natural humification process of radioactive leaves of *Beta saccharifera* which had assimilated $C^{14}O_2$, radioactive fractions of humus substances were prepared. The fulvo-acids and humic acids of the nutrient solution passed slowly, and in small quantities from the roots into the leaf. From lanolin paste spread onto the leaf the different fractions pass at different rates.

Pratt, Harlan K., and James M. Lyons. University of California. *Respiration and Ripening of Fruits of Bell Pepper* (*Capsicum annuum L.*). In bell pepper fruits, the rate of carbon dioxide production and the pattern of color changes during ripening are similar to those of the tomato; hence, a similar climacteric pattern of respiration might well be expected. Two seasons of study of this fruit have failed to develop any such consistent pattern. If large samples of fruit are matched to particular color stages (immature green, mature green, breaking color, one-fourth colored, half-colored, three-fourths colored, and full red) the initial respiration rates of these samples give a climacteric-type curve when plotted against color stage as an arbitrary time axis; this result parallels that observed with other fruits. However, the most carefully matched "mature green" or "breaker" samples fail to give a climacteric curve during subsequent storage at a favorable ripening temperature. Elucidation has been sought by study of individual fruits and by various treatments which might stimulate respiration and ripening. An occasional sample performs as hoped, but the results in general are not predictable. Treatments applied include combinations of ethylene, oxygen-rich atmospheres, and improved tissue ventilation. Biochemical studies and the development of more sensitive methods are in progress.

PRESCOTT, G. W. Michigan State University. *Fresh-water Algal Ecology with Special Reference to the Arctic.* Although species of aquatic organisms show a well-known wide distribution geographically, more so than do terrestrial forms, there are curious patterns and inexplicable disruption. Evidence is presented to indicate that there has been sufficient time, geologically, to have provided an even distribution of freshwater algae if it were not for the operation of critical factors and agencies such as variation in dissolved nutrients, light periodicity and, to a lesser degree, temperature. The role of these factors is best appreciated from analyses of algal flora ecology where there are extremes, such as in the Arctic. Data are presented to elucidate the role of certain factors in determining the composition of the Arctic flora (quantitatively and qualitatively). Seven generalities can be drawn from information at hand: (1) light (intensity, duration and periodicity) is more important than temperature; (2) low temperatures are critical only for certain species and whereas some species may be eliminated, those organisms which can adapt are as successful as at lower latitudes; (3) chemicals and nutrients determine flora quantity and quality more strikingly than in habitats of lower latitudes; (4) desmids, in general, are more adaptable to Arctic habitats than any other single group of algae unless it be the Diatoms; (5) organisms well provided with carotenoids and xanthophylls are curiously adapted when certain other optimum factors are present; they may be present in good numbers when all other classes of algae are absent; (6) cyanophyta are scant in number of species and individuals; (7) many algal species, especially in Volvocales, Tetrasporales, and among pigmented flagellates exist permanently in an arrested or encysted condition.

PRESTON, R. D. University of Leeds. *Theoretical and Practical Implications of the Stresses in the Water-conducting System.* There are three main ways in which the stresses may be estimated: (*a*) through estimates of the tensile strength of water under appropriate conditions; (*b*) through calculation, under assumptions, from known linear rates of water movement; (*c*) by direct measurement. Both the older and the more modern work on all three of these is reviewed and this forms the bulk of the lecture. It is shown that, discarding what appear to be impossibly high figures under (*c*), the real stresses in water-conducting systems come much nearer to the tensile strength of water than has commonly been supposed. This leads to the suggestion that the putative water columns in xylem can readily be broken. Evidence is presented from several sources that such fractures are widespread and that the bulk of the conducting elements contain gas, initially under reduced pressure. It is further shown that in theory a few intact water columns will nevertheless supply the needs of the tree but (if time permits) that there are observations which do not harmonize even with this modification of the classical cohesion theory.

PRESTON, R. D. University of Leeds. *Wall Structure in Marine Algae.* The structure and composition of the walls of many species of green, brown, and red algae are reviewed. Physically, these algae fall into three groups: I, a few algae (some Cladophorales, some Siphonales) containing well-oriented cellulose I with microfibrils lying in two or three directions; II, the bulk of the algae, containing randomly arranged polysaccharides, probably cellulose derivatives, resembling but not identical with cellulose II (the microfibrils are much narrower than in group I); III, a few algae with highly crystalline polysaccharides of unknown nature. A study of developing zoospores shows that in group I the crossed fibrillar structure is developed within a few hours of settling. Chemical extraction, coupled with hydrolysis of the extracts, paper partition chromatography, and electron microscopy, shows that, in general, the "celluloses" of these algae contain sugars other than glucose, often in high proportion. In group I, however, the (highly crystalline) celluloses appear to contain glucose only. It is suggested that these should be distinguished as "eucellulose." The nature of the incrusting substances is also elucidated and it is shown that even the most highly organized walls are labile and can, under appropriate conditions, be destroyed in living cells.

PREVOT, P., et M. OLLAGNIER. Institut de Recherches pour les Huiles et Oléogineaux, Paris. *Equilibres, interactions et facteurs limitants dans l'étude des fumures minérales par diagnostic foliaire.* La notion de fumure dite équilibrée est discutée. Des exemples, fournis par les études de l'Institut de Recherches pour les Huiles et Oléagineux, montrent que la courbe de réponse aux engrais ne présente pas un maximum distinct, mais a la forme d'une courbe à long plateau correspondant à une consommation de luxe. Lorsqu'une carence principale est corrigée, la corrélation entre le rendement et les teneurs en cet élément disparait. A ce moment, on peut observer des teneurs très différentes pour des rendements comparables ou (et) des rendements différents pour des teneurs comparables. Cette absence de relation étroite entre rendement et teneurs résulte de l'existence dans la plante de "systèmes tampons" qui font que l'activité physiologique des éléments déterminés globalement par le diagnostic foliaire peut être très différente, selon l'état des éléments dans la plante. Des exemples en sont donnés pour le manganèse sur le palmier à huile et l'arachide. Si la notion de "fumure équilibrée" peut présenter un intérêt théorique, l'utilisation de la loi des facteurs limitants de Blackman — ou du facteur au minimum de Liebig — associé aux expériences de type factoriel, s'est montrée particulièrement efficace dans l'étude pratique des fumures minérales.

PRITCHARD, R. H. Hammersmith Hospital, London. *Irregular or Non-Mendelian Segregations Encountered in Fungi and Other Plants.* According to Mendelian theory, two of the four products of a heterozygote A/a should carry the allele A and two the allele a. Exceptions have been found in most organisms which permit tetrad analysis, for which an explanation on the basis of known genetic mechanisms (such as polysomy or gene interaction) is unsatisfactory.

Hypothetical processes of two kinds have been suggested to account for these exceptions: the directed mutation of one allele under the influence of an homologous allele in a heterozygote, and the copying of a segment of the genetic material twice on one of the two alternative templates in a heterozygote. Critical evidence for the existence of a mechanism of the first type is difficult to obtain. The occurrence of a mechanism of the second type is suggested by data from yeast, *Neurospora,* and *Aspergillus.* Such a mechanism implies the coincidence, with greater than random frequency, of more than one recombination event in a very short segment of the linkage map. This might be taken as evidence that the recombination events involved were different from those responsible for crossing-over. But there is evidence that a localized correlation between recombination events, reciprocal or otherwise, is a feature of recombination in general, and the occurrence of tetrads with ratios other than 2:2 can therefore be interpreted on the basis of a generalized theory of recombination.

PRITCHARD, TOM. The Nature Conservancy, London. *Cytotaxonomy and Ecology of the Weedy Species Euphorbia cyparissias L. and Euphorbia esula L.* Tetraploid ($2n = 40$) and sterile diploid ($2n = 20$) forms of *E. cyparissias* which are weeds in Canada also occur in Europe and a previously unknown fertile diploid form was recently discovered in the forest of Fontainebleau, France. Cell size and diameter of pollen grains were used as criteria to distinguish between herbarium specimens (obtained from European herbaria) of diploid plants and those of tetraploids. It is apparent that the tetraploid occurs more frequently, and has a wider distribution range, than the fertile diploid in Europe. The tetraploid exhibited stronger vegetative reproduction than the fertile diploid when the growth behaviour of the two forms was compared in an experimental plot. In Great Britain, the fertile diploid is apparently absent, but the tetraploid exists as a weed in some localities. The sterile diploid is largely confined to gardens as an ornamental but has escaped in a few cases. The tetraploid and fertile diploid hybridise freely. The tetraploid and *E. esula* are also interfertile, but the fertile diploid and *E. esula* do not hybridise. In Britain, *E. esula* is highly variable, but all the populations studied had $2n = 60$, are self-incompatible, interfertile, thus suggesting that all the forms belong to one species. It is suggested that polyploidy and hybridisation are involved in the origin of tetraploid *E. cyparissias* and probably connected with its spread as a weed.

PROCTOR, G. R. *See* SKELDING, A. D.

PROSKAUER, J. University of California. *Phylogeny of the Anthocerotales: Spiral Thickening in the Columella.* The cells of the columellae of Anthocerotales are typically devoid of spiral thickening even in those genera (*Dendroceros, Megaceros*) in which the compound elaters show such thickening and form seemingly a complex conducting system. Two exceptional cases have come to light. (1) In *Dendroceros crispus* (from: St. Helena; Jamaica, Type; Hawaiian Islands) the outermost layer only of the columella cells invariably possesses a very faintly developed spiral thickening. This thickening differs both in intensity and detail of development from that of the elaters at the corresponding level of the sporophyte. It is apparently functionless, but its development follows a regular pattern. In some specimens, at least, faint thickenings could also be demonstrated in the lining layer of the jacket. (2) In a *Megaceros* from Hawaii the columella shows considerable *irregularity*. It may contain some spirally thickened cells, and sometimes it may even break up and lose its identity as a columella. The thickenings here are like those of the elaters at the corresponding level. The second case seemingly just parallels the tendency seen in Notothylaceae of the merging of columella and sporogenous tissue. The first case, however, is in accord with the postulated connection between Anthocerotales and Psilophytales, with a possible special bearing on the "tapetum" of *Horneophyton*.

PROVASOLI, L. Haskins Laboratories, New York. *Growth Factor Requirements of Algae: Ecological and Cultural Implications.* Many freshwater and marine unicellular algae require vitamins for growth. Though only about a hundred algae have been studied so far, it is possible to discern some patterns. The *Chlorophyceae* and the *Bacillariophyceae* are the two algal groups in which only a few species are auxotrophic. On the contrary, all the species investigated of *Cryptophyceae, Dinophyceae,* and *Eugleninae* require one or more vitamins. Cyanocobalamin, thiamine, and biotin are the only three vitamins required by the photosynthetic species. The order of incidence of requirements appears to be cyanocobalamin, thiamine and biotin. Incidence of auxotrophy does not correlate with any particular environment, nor with the energy source, that is, obligate or facultative phototrophy or heterotrophy. The stereotyped pattern of need of only three vitamins seems to indicate a physiological evolutionary tendency toward loss of function peculiar to the algae. Ecological and nutritional implications will be discussed. (This work was supported in part by grant G-3216 of the National Institute of Health, U.S. Public Health Service and contract NR 104-202 with the U.S. Office of Naval Research.)

PROVASOLI, L. *See* PINTNER, I. J.

PRYWER, CZESLAWA. Escuela Nacional de Agricultura, Chapingo, Mexico. *Meiosis in the* F_1 *Hybrid of Tripsacum maizar Hdz. X. & Randolph* × *T. zopilotense Hdz. X. & Randolph.* Cytological study was made of meiosis in an F_1 hybrid between two diploid species: *Tripsacum maizar* ($2n = 36$) × *T. zopilotense* ($2n = 36$) produced by L. F. Randolph of Cornell University. Prophase I in meiotic division shows normal synapsis and in diakinesis 18 bivalents are evident. In most of the cells, the various phases of meiotic divisions are normal; in some, the following aberrations were found: (*a*) in anaphase I the chromosomes do not move towards the poles, and (*b*) in telophase I both chromosome sets remain together and a nuclear membrane may form around them. The second meiotic division shows similar types of aberrations. In Mexico the presence of segregating populations of *Tripsacum* is common. The members of these populations have been found to be tetraploids with morphological characters intermediate between those of the diploid species mentioned in this study. From the cytological observations reported, these populations may have originated from amphidiploids of a *T. maizar* × *T. zopilotense* hybrid or from the cross between their autotetraploids possibly growing close to the diploid populations.

PURI, G. S. Botanical Survey of India. *The Concept of Climax in Forest Botany of India.* In India, the monoclimax theory of Clements is applicable to all types of vegetation and in all regions of the country. The climax vegetation over most parts is a forest, there being no climatic grasslands or savanna. Mangroves are a specialized edaphic variant. In the Himalayas, oak form climatic climax and the conifers or mixed oak-conifers, with or without other broad-leaved types, are biotic or bio-edaphic variants. In the Indo-Gangetic plains, a moist deciduous forest of *Prosopis, Salvadora,* etc. is a climax. The Aravallis have a climax vegetation of *Anogeissus pendula.* In Central India, *Shorea robusta* is dominant. In the Vindhyas, a mixed community with teak, *Terminalias, Anogeissus, Hardwickia,* and *Boswellia* is present. The Deccan Trap country and the Satpuras have a mixed vegetation of teak, *Terminalias,* and *Boswellia* on basalt, whereas ferruginous clay bears an evergreen forest with *Eugenias, Memecylon, Actinodaphne, Mangifera,* and *Sideroxylon.* The western coast below Belgaum has a true evergreen forest with species having affinities with the Malayan region. The *Dipterocarps, Garcinia, Vateria, Mesua, Hopea, Calophyllum,* etc. are also distributed in Assam. The evergreen forest is developed as a climatic climax in both the Western Ghats and East India as a result of the direction and intensity of monsoon.

PURI, G. S. Botanical Survey of India. *Vegetation of India, Its Past, Present, and Future.* The climax vegetation over most parts of India is an evergreen forest dating back to the Tertiary Period. During the Pleistocene glaciation the Himalayas were invaded by conifers and now pure conifers, or oak-conifer seral communities occur along with oak climaxes. The oak climaxes become more predominant towards the eastern Himalayas. The Siwaliks also had an oak climax, which has been replaced by moist-deciduous and deciduous communities of *Shorea-Terminalia-Anogeissus* types. The Aravallis have climax *Anogeissus pendula* and the Great Indian Desert has climax evergreen vegetation of *Prosopis spicigera, Salvadora.* The evergreen vegetation of the Indo-Gangetic plains also includes the above species mainly. The Vindhyas, Satpuras, and the Deccan Trap have moist or dry, mixed deciduous communities with teak, *Hardwickia, Terminalia,* predominating. In the Western Ghats, and Eastern India, Dipterocarpaceae, Guttiferae, and Leguminosae are prominent. Since the post-glacial period through pre-historic and historic times, evergreen vegetation has suffered greatly from natural and human agencies. Thus, savannahs, grasslands, deserts, and scrubs are recent in origin. Because of the danger of biotic interference, conservation supplemented with planting of economic species on a large scale has been undertaken. It is likely that the future vegetation of India may have large stretches of artificial forests of economic species such as *Cedrus, Dalbergia, Shorea, Tectona,* rubber, mulberry, and even coconut. At any rate, the trend is towards disturbance and destruction of the evergreen climatic climax.

PURI, V. School of Plant Porphology, Meerut, India. *On the Structure and Evolution of Angiosperm Carpel.* The so-called classical concept of the angiosperm carpel has been subject to much adverse criticism during recent years. The present study, undertaken to check some of this, has revealed that the findings which necessitated the expounding of the conduplicate concept can still be explained — and perhaps more satisfactorily — in terms of the classical concept. It has been asserted, for instance, that in some primitive ranalian families, for example, Degeneriaceae and Winteraceae, the ovules are not borne marginally as the classical concept implies, but superficially on the ventral surface of the carpel. We are inclined to believe that this assertion is based on lack of proper appreciation of the structure and magnitude of the carpellary margins. In contrast to the condition in foliage leaves, carpels ordinarily possess much better developed margins which obviously have: (1) an outer face (a part of the dorsal surface); (2) an inner face (a part of the ventral surface) that usually bears ovules; and (3) a lateral face that represents the thickness of the margins and is involved in fusion of margins whenever it occurs. The occurrence of this lateral face, which is usually sterile, is an important structural feature that seems to have been completely ignored so far in discussions of carpel porphology. It can be clearly distinguished from the ventral surface, with which it seems to have been confused even by competent authorities, by the orientation of the ventral rallel to the lateral face and perpendicular to the ventral surface. This being so the ovules in general, such as *Degeneria, Drimys,* and *Cananga,* are not superficial but essentially marginal. Another point that has been brought against the classical concept is that in t.s. very young carpels, carpellodes, and styles often present a conduplicate appearance and do not show any involute folding as is envisaged in the classical concept. We have evidence — both ontogenetic and anatomical — to show that these apparently conduplicate structures are sections of "solid" carpels, carpellodes, and styles in which the locule, with its ventral surface, has not yet developed (young carpels) or has disappeared (styles). What is seen in these sections is the general dorsal surface of the carpel and the lateral faces of its margins which have been brought together obviously through involution. There is no ventral surface in these sections and hence no conduplication. All this strengthens our faith in the classical concept as a "convenient instrument of description."

PURVES, WILLIAM K. Yale University. *Sugar and Auxin Interactions in Pea Stem Growth.* The growth of etiolated pea epicotyl sections is promoted by auxins and sugars. When sucrose and indoleacetic acid (IAA) are supplied simultaneously, a complex interaction results. For example, the concentration of IAA producing maximum elongation shifts through at least three orders of magnitude in response to varying sucrose concentrations, and inhibition by high IAA concentrations occurs only if sucrose is also present. By contrast, the IAA optimum for water uptake is little affected by the sucrose concentration. The promotive effect of IAA on growth occurs immediately, but the growth response to sucrose does not appear for about 7 hours. The effect of sucrose at the end of this lag period is strongly affected by the IAA concentration. Sucrose potentiates the effects of brief exposures to IAA; in the presence of 2 per cent sucrose, 1-hour exposures to IAA are as effective as 20-hour exposures in promoting or inhibiting elongation. These findings bear upon current theories of promotion and inhibition of elongation by auxin. They indicate a partial independence of these effects.

PURVIS, O. N. Imperial College of Science & Technology, London. *The Effect of Vernalisation Applied at Various Stages of Development in Winter Rye.* Vernalisation treatment, given to growing plants of winter rye at various times after germination, showed that low temperature accelerated flowering at any stage before initiation. The later in development the low temperature treatment was given the less was the acceleration of flowering when compared with unvernalised controls, owing to the fact that eventually the control plants also reached the stage of initiation without exposure to low temperature, so that, the longer the delay in applying low temperature treatment, the more advanced were the processes leading to flowering and the less the need for low temperature.

Quadling, C. Canada Department of Agriculture. *Mutation in Phytopathogenic Bacteria: Studies on Xanthomonas phaseoli.* The investigation of the ability of a bacterial species to cause disease in plants is seen as a problem in microbial ecology. The use made of mutant strains of pathogens in the analysis of disease-causing processes is reviewed and some suggestions made for further uses of mutant pathogens in the investigation of bacterial diseases of plants. Some experimental work on the virulence for beans of mutant strains of *Xanthomonas phaseoli* is also reported and discussed. In brief, mutants (apropos of growth factors and other characters) were prepared by orthodox selective methods and by ultraviolet irradiation. Various degrees of virulence were found ranging from avirulent to unchanged virulence. The observed virulence was also a function of the method of testing adopted.

Quarterman, Elsie, and Catherine Keever. Vanderbilt University and Millersville State Teachers College, Tennessee. *Climax Forest of the Longleaf Pine Belt of the Southeastern United States.* The seral position of hardwood stands on upland sites in the longleaf pine belt of the Coastal Plain of southeastern United States has been in question. Phytosociological studies, in which widely distributed stands were sampled, have been conducted over a three-year period. Soils from each of the sampled stands were analyzed mechanically and for major nutrients. These studies have established the continuity throughout the area of a mixed hardwood type of forest unified by certain binding species in a way similar to the various portions of the mixed mesophytic forest of Braun. Data obtained provide evidence for regarding this mixed hardwood type as the regional climax.

Quispel, A. Der Universiteit van Amsterdam. *Some Aspects of Root Nodule Symbiosis in Non-leguminous Plants.* In an increasing number of root nodules of non-leguminous plants, nitrogen fixation has been observed, while in other species nitrogen fixation is probable. Though these nodules are observed in plants belonging to unrelated families, the cytological examination points to a great similarity although they differ in certain respects from the nodules of leguminous plants. On the other hand, experiments on the influence of external circumstances on nodulation have shown that many similarities exist between the leguminous and non-leguminous nodules. Study of the root nodule symbiosis of non-leguminous plants is most hampered by the fact that the endophytes cannot be cultivated outside the host plant. For certain types of experiments, however, it may be an advantage that the endophyte does not multiply in the surrounding of the roots, for example, in all experiments where the inoculation density has to be controlled. By an indirect method it has been shown that a small growth *in vitro* of the endophyte of *Alnus* is possible if a lipophilic substance from *Alnus* roots is added to the nutrient solution. A direct examination of such six-week-old cultures has revealed the presence of some small clusters of actinomycete-like hyphae. Experiments are in progress to elucidate the chemical nature of the growth-promoting substance.

Rabotnov, T. A. Moscow. *The Effect of Reproduction by Seed on the Composition of Meadow Plant Communities.* The seedlings of many species become well established and develop into mature plants under experimental sowing on certain types of flood meadows, among them some which were previously almost or quite absent. This resulted in a change in the composition of communities and sometimes also in yield. These changes depended upon: (1) species; (2) the number and vigour of the individuals produced; (3) the period of their influence. The invasion of a new component or a considerable quantitative increase of the species sown usually results in the decrease of some other components. Those species whose abundance decreases usually belong to other biological types than the introduced plants. For example, as a result of sowing *Archangelica officinalis* Hoffm., *Heracleum sibiricum* L., *Libanotis intermedia* Rupr., the abundance of grasses, especially rhizomatous ones (*Agropyron repens* (L.) P.B., *Bromus inermis* Leyss., *Agrostis alba* L., *Poa pratensis* L.), significantly decreases. The reactions of individual grass species were conditioned by available nutrients, especially nitrogen. Under mass reproduction of individual species by seed, the yield: (1) decreased (by sowing *Rhinanthus major* Ehrh.); (2) did not change (by sowing *Archangelica, Heracleum, Libanotis*); (3) increased (by sowing *Medicago falcata*). Thus, the experiments show that composition and yield of meadow communities may depend not only on environment but also on the possibilities of the reproduction of plants by seed.

RABSON, R. University of Houston. *Some Aspects of Serine Metabolism in Plants.* Serine-C^{14} was rapidly metabolized to many compounds when administered to excised leaves. Glyceric acid consistently became radioactive in these experiments. This conversion of serine to glyceric acid was investigated using specifically labeled intermediates. The glyceric acid, extracted from corn, barley, or coleus leaves which were administered serine-3-C^{14} for 15 or 30 minutes in darkness, had essentially all of the radioactivity in the β carbon. This suggests that glyceric acid can arise from serine by a direct pathway. The possibility that glyceric acid may arise from serine during photosynthesis was also investigated. When mint leaves were allowed to photosynthesize for 20 seconds in the presence of $C^{14}O_2$, the C^{14} distribution in the carbon atoms of serine was approximately uniform. The phosphoglyceric acid (PGA) had most C^{14} label in the carboxyl carbon, that is, about four times greater than either the α or β carbon. Since the labeling in glyceric acid appeared to be a composite of the patterns in serine and PGA (only about twice as much label in the carboxyl carbon as in the α or β), it may be suggested that glyceric acid derives label from serine and PGA. In experiments with leaves of other plants the results indicate that the magnitude of the serine to glyceric acid conversion during photosynthesis varies among species.

RADFORTH, NORMAN W. McMaster University. *Palaeobotany in Canada: The First Hundred Years.* Palaeobotanical study and enlightenment are not always functions solely of the actions of many, concentrated upon a major axis of endeavour, however justifiably fashionable that may be, or of the inevitable secondary ends of which the needs of stratigraphy are an example. On the contrary, it refreshingly obtains that where there are voids in palaeobotanical endeavour, inspiration to initiate new study arises as an outgrowth of the philosophy of single individuals. Canada has had only two famous palaeobotanists. Sir William Dawson became Principal of McGill University and first President of the Royal Society of Canada, and Walter Bell, the Director of the Geological

Survey of Canada from 1949 to 1953. Bell's responsibilities were somewhat appalling when it is realized that Canada, with its 3,845,144 square miles exposed at last by techniques of new exploration and with a modern Survey and its all-inclusive aims, was something different in his time than it was in Dawson's. Present palaeobotanical trends in Canada, however new and promising they may prove to be, can never presume to delineate another regime. The memoirs of Dawson and the works of Bell are complementary and together have "gone full circle." They are revealing to philosophy, contribute generously to scientific principle, relate to natural expediency and testify for academic achievement generally. Present endeavour in Canadian palaeobotany, as reflected in its bibliography, is directed to shedding light on the origin of biological trends, to the discovery of new flora, to the utilization of microfossils for establishing the earliest levels of biological antiquity and community identity, and, for the recent past, to interpretation of organic terrain. The generating stimulus is not to be found primarily in expediency; it is in the philosophical legacy of Dawson and the contributions of Bell.

RAJHATHY, T., and J. W. MORRISON. Canada Department of Agriculture. *Cytogenetic Studies in the Genus Avena.* The morphology of oat chromosomes is described in this report, and the classification into genomes attempted on this basis. The genomes designated on karyotypical features are discussed in relation to the results obtained by other methods, such as pairing behaviour in interspecific hybrids. The results obtained indicate allopolyploidy. To find the species carrying the *Avena* genomes a broad and detailed taxonomical, cytological, and geographical survey has been initiated. Hybridization has been carried out within the genus *Avena.* The pairing behaviour of chromosomes in certain colchicine-induced allopolyploids, in hybrids, and in segregated forms is described.

RAJHATHY, T. *See* MORRISON, J. W.

RAJKOVA, H. A. Taschkent, U.S.S.R. *Spontaneous Hybridization and Grass Hybrids in the Pamirs.* Spontaneous hybridization in nature occurs with various frequencies in many plant families, but the grass family (Gramineae) provides numerous and interesting facts for the theory of the formation of species in nature, by means of hybridization. In the divergent process of species formation, hybridization (provided there are the necessary conditions such as isolation and extreme living conditions) comes out as one of the factors in the transformation of the vegetable world, creating new forms, races, and species. The Hordeae, which include numerous sterile and individual fertile hybrids of wild species described in nature (by M. G. Popov, H. A. Rajkova, and others) and in herbaria (by S. A. Nevski and others), are of considerable interest as an illustration of this fact. Fertile hybrids are potentially new species. Among these we may mention *Elymus divaricatus* Drob (*Agropyrum trichophorum* Link × *Elymus angustus* Trin.) from the outskirts of Burni (M. G. Popov, 1927) and *Agropyrum tenerum* Vasey × *Clinelymus nutans* (Griseb.) Nevski which originated on the experimental fields of the Pamir Biological Station. The new species originated in the contacting habitat of the parental species and the area of their population is limited by the conditions of a peculiar isolation. In the Eastern Pamirs, in natural conditions of contacting habitats of the parental species, one can often come across spontaneous sterile hybrids *Hordeum turkestanicum* Nevski with *Clinely-*

mus nutans (Griseb.) Nevski and less often *Hordeum brevisubulatum* (Trin.) Link with *Clinelymus nutans* (Griseb.) Nevski. The above-mentioned species hybrids were often developed during experiments at the Biological Station in conditions of mixed crops. The formation of hybrids is facilitated by contacts, changed conditions, and peculiarities of flowering biology. The two species of *Hordeum* are obligatory cross-pollinators, whereas *Clinelymus nutans* is a self-pollinator. In noting the frequent and diverse cases of spontaneous hybridization under extreme living conditions in the Pamir high altitude mountains, we think that their study would help to disclose the ways in which genetically connected groups are formed and the regularities in the present form and species formation.

RANDOLPH, L. F., and JYOTIRMAY MITRA. Cornell University. *Karyotype Analyses and Species Relationship in Iris.* Recognition of the importance of karyotype analyses in studies of species delimitation and the establishment of natural relationships of subspecific categories as geographic races and subspecies, as well as of higher taxa began with the early works of Navashin, Delaunay, and Lewitsky. Later important contributions towards phylogenetic significance of karyotype analyses have included outstanding researches of Babcock, Stebbins, and co-workers on the genus *Crepis* and studies of *Holocarpha* species by Jens Clausen, where it was possible to deduce evolutionary trends within the genus. In the genus *Iris* both polyploidy and dysploidy have contributed to the origin of existing species, and among the polyploids both allo- and auto-polyploids have been identified. In *Iris pumila* the mechanism of reduction of chromosome number from 32 to 30 in a geographic race indigenous to the Crimea is described. Among the Pogoniris, Regelia, and Oncocylus sections, a reduction from 12 to 11 to 10 apparently has occurred along with a shift from some metacentric to exclusively acrocentric type of chromosomes, for which inversion of the dibrachial type with the break in the two arms at unequal distances from the centromere appears to be responsible. The karyotypes of various *Iris* species are described and illustrated.

RAPER, JOHN R. Harvard University. *Parasexual Phenomena in Basidiomycetes.* Numerous recent studies indicate somatic recombination between the compatible nuclear components of dikaryons as a regularly occurring feature of this highly specialized type of heterokaryon. A number of odd phenomena among the Basidiomycetes, long known and puzzling, find a rationale in genetic recombination in the vegetative dikaryotic mycelium: in the Hymenomycetes, the reaction between dikaryons and homokaryons in incompatible combinations (the illegitimate Buller Phenomenon) and the frequent occurrence of novel, unexpected genotypes in the corresponding compatible combinations (the legitimate Buller Phenomenon); in the Uredinales, the appearance of recombinant mycelial types in mixed dikaryotic infections. The inter-mycelial reactions that have been used to detect somatic recombination are complex and imperfectly understood; the intra-mycelial details of recombination, time, frequency, and influencing factors, have not been studied previously and are consequently known only by inference. The direct examination of the vegetative dikaryon, utilizing methods that require no selecting mycelial mate, reveal somatic recombination to be highly variable in its manifestations, to occur in frequencies up to approximately 3 per cent of the dikaryotic nuclear population, and to yield nuclear products that are indistinguishable from those produced in meiosis. Although the information concerning somatic recombination in the Basidiomycetes is still meagre, it is evident that the cryptic sexual processes—the interplay of genic reassortment and selection at the nuclear level in, between, and from heterokaryons—may well have far reaching significance in the biology of the higher fungi.

RASKI, D. J., and W. B. HEWITT. University of California. *Further Studies on the Transmission of Fanleaf Virus by Xiphinema index.* Experiments have established that fanleaf virus is persistent in the dagger nematode, *Xiphinema index.* Viruliferous nematodes propagated on the roots of infected grapevines transmitted the virus to healthy St. George rootings after the nematodes had been kept up to 30 days without a host plant in moist sterilized soil. It has also been determined that two different larval stages as well as adult female nematodes transmitted the virus. In two of these tests, one with larvae and one with adults, transmission occurred when as few as five hand-picked specimens were introduced into the root zone of healthy plants. Feeding periods of intervals ranging from one to 28 days, in which 600 viruliferous nematodes of all stages were used in each test, demonstrated that transmission of the virus occurred within the first day.

RÁSKY, KLARA. Hungarian National Museum, Budapest. *The Upper Oligocene Flora of Ipolytarnóc, Hungary.* A great many fossil leaf, fruit, and flower remains were collected from the rhyolitic tuff at Ipolytarnoc, 48°15′:19°40′, in North Hungary, the geological age of which, as concluded from the character of the flora, is Upper Oligocene. Most of the leaves were compared with those of species living today on the southern slopes of the Himalayas, in Assam, Burma, Malaya, and South China. The fossil foliage is mostly mesophyllous, to a lesser degree micro- and macrophyllous. From the mixture of various kinds the following may be emphasized: the lichen *Lobaria, Calamus, palmleaves, Araceospadix, Magnoliaestrobus, Scolopiae-phyllum* (found also in the Upper Eocene of Hungary), *Barringtonia,* and *Schefflera.* The structure of this forest may have been very complex. It consists of a great number of rather scattered species. It suggests partly a semitropical rain forest and partly a recent monsoon forest, with *Calamus.* Its structure shows rather a confusion of taller and shorter trees, palms, ferns, and aroids, and interdependent climbers and epiphytes. The paleoclimate was clearly warm and humid. The findings of Ipolytarnoc prove the presence in the Hungarian Tertiary of several genera which did not persist to modern times.

RATNER, E. I. and G. W. BARINOW. Academy of Sciences, Moscow. *Absorption and Translocation of Mineral Elements Applied to the Leaves of Plants.* Experiments with mineral salts labeled with p^{32}, S^{35} and Ca^{45} show that there is a dead period in the uptake of mineral substances (absence of uptake in the initial period). The duration of this dead period depends on the properties of the substances applied to the leaves and on the anatomic peculiarities of the leaves. It may be of the order of several hours. Since the solution applied to the leaf loses water by the end of the dead period, the subsequent rate of absorption of mineral substances contained in the solution depends foremost on the hygroscopic properties and solubility of these substances. Thus, for sodium and potassium phosphate solutions, possessing various pH values, the solubility plays a more significant role than the pH value. Flow of absorbed mineral substances from the leaf is subjected to sharp variations depending on the physiological state of the plants and on external factors. In experiments carried out with tomatoes, whose leaves were supplied with doubly labeled Ca^{45} $(H_2p^{32}0_4)_2$, it was found by separately tracing Ca^{45} and p^{32} with different types of counters that the Ca^{45} mobility is only 1.3-2.0 times smaller than that of p^{32}. Conditions leading to enhanced flow of p^{32} also led to an increase in the flow of Ca^{45}, and, conversely, a weak flow of Ca^{45} corresponded to a weak flow of p^{32}. A descending movement of Ca^{45}, as well as p^{32}, was observed to occur to all plant organs, including the roots. Of all complementary cations, potassium was the most effective in increasing the flow of p^{32}.

RAVEN, PETER H. University of California. *Evolutionary Consequences of Interspecific Hybridization in Oenothera, Subgenus Chylismia.* Groups of annual plants of desert habitats may be particularly instructive with regard to evolution because of the rigorous selective pressures imposed by the desert environment. With this in mind, study was initiated on *Oenothera,* subgenus *Chylismia,* a small group of desert annuals and short lived perennials restricted to arid areas of western North America. Nearly all of the species are diploid, and balanced lethals are unknown. At meiosis, all species regularly form seven pairs or at most small rings. *Oe. clavaeformis,* the most widespread species of the group, hybridizes in many localities with the conspicuously different *Oe. brevipes,* forming hybrids that have greatly reduced fertility and show large chains of chromosomes at meiosis. The evolutionary impetus provided by this interspecific hybridization, its taxonomic consequences, and its relation to the rapidly changing desert environment are discussed.

RAVEN, PETER H. *See* LEWIS, HARLAN

RAYMOND, MARCEL. Montreal Botanical Garden. *Statistique des Cypéracées du Québec.* Couvrant plusieurs zones biologiques, offrant une grande variété d'habitats et situé au carrefour de plusieurs voies de migration, le Québec, dont la flore vasculaire est de l'ordre de 2,000 espèces, est riche en Glumiflores. Les Cypéracées à elles seules comprennent 268 espèces réparties en 12 genres, comme suit: *Carex* (197), *Scirpus* (22), *Eleocharis* (18), *Eriophorum* (12), *Cyperus* (8), *Rhynchospora* (4), *Kobresia* (2), *Hemicarpha* (1), *Dulichium* (1), *Bulbostylis* (1), *Fimbristylis* (1), *Cladium* (1). Pour s'en tenir au genre *Carex* des comparaisons sont faites avec d'autres pays; il peut y avoir un certain flottement dans les chiffres, à cause des divers concepts spécifiques, mais des rajustements ont été faits dans un sens plutôt conservateur. Les hybrides sont exclus. Voici quelques statistiques: Norvège (93), Iles Britanniques (77), France (105), Pologne (96), Tchéco-Slovaquie (82), Portugal (40), Sibérie Centrale (94), Mongolie (71), Mandchourie (85), Kamtchatka (64), Sakhalines (69), Corée (170), Japon (175), Formose (61), Malaisie, s.l. (110), qu'on peut décomposer ainsi: Péninsule Malaise (16), Sumatra (38), Philippines (30), Java (37), Bornéo (18), Nouvelle-Guinée (44); Indo-Chine, s.l. (83), qu'on peut décomposer ainsi: Thailande et Basse Birmanie (31), Tonkin (46), Annam (31), Laos (17), Cambodge (6), Cochinchine (4); Nouvelle Zélande (60); Hawaii (9), Polynésie (15); Madagascar (29); Alaska et Yukon (105), Colorado (93), Californie (140); Manitoba (125), Nouvelle-Ecosse (96); Terre-Neuve (102); Argentine (c. 60); Bolivie (14); Antilles (9). L'absence de monographies récentes empêche de faire figurer la Chine (c. 300) et l'Inde (c. 200). Or, l'Europe ne compte pas plus de 150 espèces et l'Afrique 60, par contraste avec l'Amérique du Nord qui en a plus de 500. C'est donc seulement avec la Chine, l'Inde, la Corée et le Japon qu'on peut comparer numériquement les *Carex* du Québec.

RAYMOND, MARCEL. *See* SMITINAND, TEM

RAZUMOV, V. I. Institute of Plant Industry, Leningrad. *On Vernalization Problems.* Professor Chouard in his report has developed a broad perspective for further investigation of the vernalization phenomenon fully covering the whole problem. This perspective is very plausible and it would be desirable only to add some points in order to make it more complete. (1) The features leading to vernalization of a given plant species or a given variety should be studied with regard to its geographical origin and habitat. Such a comparative study reveals the regularities in the geographical distribution of varieties with different lengths of chilling period, as well as establishing the distribution of varieties undergoing the vernalization at a temperature below 0°. (2) The vernalization phenomenon was studied mostly on winter plants and biannual monocarpic plants; now it becomes clear that some perennial polycarpic plants need a definite chilling period too, and that for the summer plants a period of chilling is necessary, especially if grown on a short day. (3) In order to maintain the process, a steady flow of metabolic substances to the meristematic cells undergoing vernalization is necessary. Therefore, both the conditions and the velocity of the vernalization process in seeds and vegetating plants are different. The interrelationship between growth and development becomes of great importance in the vernalization of vegetating plants. (4) Some organic acids may accelerate the vernalization of winter plants. These acids (gibberellin included) are incapable, however, of stimulating earing of the typical winter plants when grown under high-temperature conditions. Gibberellin cannot replace vernalization, it may merely accelerate this process. (5) Of great theoretical interest is the investigation of similarities and differences between the processes of vernalization and stratification.

REEDER, JOHN R. Yale University. *The Grass Embryo in Systematics.* That the grass embryo possesses characters of taxonomic significance was first pointed out more than half a century ago by the French botanist Van Tieghem. He found that there are two main types, and that when grasses are classified on this basis the two groups correspond rather closely with the two subfamilies which had been recognized much earlier on the basis of gross morphology. Recent study of grass embryos in both longitudinal and transverse section has revealed four important characters. On the basis of these characters, six distinctive embryo types may be recognized: (1) true festucoid, (2) true panicoid, (3) chloridoid-eragrostoid, (4) bambusoid, (5) oryzoid-olyroid, and (6) arundinoid-danthonioid. In the majority of cases there is a striking correlation between the results of these embryo studies and those based on epidermis and anatomy of leaves, chromosome size and number, etc. During the course of this study, embryos were examined from grasses representing more than 150 genera and all tribes usually recognized.

REINHARD, ERNST. Universität Würzburg. *Vascular Tissue Differentiation in Roots.* The following questions are interesting in respect of this subject. (1) Is the differentiation of vascular tissues in the root the result of homoiogenetic determination or can the meristematic tissue of the root tip "autonomously" differentiate the vascular pattern? Jost asked this question and concluded that vascular tissue continues under the influence of root parts already differentiated. This opinion is opposed in papers by Ball, Clowes, Reinhard, and Torrey, which indicate independent differentiation of meristematic tissue. (2) How is the vascular pattern formed in the independent determination of the meristematic tissue? Papers of Bünning, Reinhard, and Torrey are discussed in this connection. According to Bünning, the first perceptible differentiation of the vascular tissue in the root of *Sinapis alba* is a polarity of cells of the central cell-line of the plerome. By this radial polarity the place of formation of the xylem rays is determined in the vicinity of root initials. Reinhard proved that the modification of the vascular pattern is indicated by a change of polarity within the central cell-line of the plerome. However, further proof is needed as to whether the cells of the central plerome row actually cause any determination. Torrey connects the formation of the vascular pattern with the diameter of the procambium ring. This question as well as the role of reciprocal inhibition by regions of active differentiation and its relation to the formation of the vascular pattern are discussed.

REISS, F., and M. CRONIN. New York University and Schering Research Laboratories, Bloomfield, New Jersey. *The Effect of Griseofulvin on Protein Synthesis.* The effect of griseofulvin on protein synthesis in relation to the presence or absence of desoxyribonucleic acid is presented. Studies have been conducted on the scalp and skin.

REMESOV, NEIL. University of Moscow. *Influence of the Oak Forest on the Chemical Properties of Soil.* The changes which are caused by the soil-forming process are revealed in the shortest time and to the most marked extent on sandy parent rocks. This was the reason for carrying out investigations on the dynamics of biological nutrient elements in the oak forests of the Voronezh State Forest Reserve, which are situated on quartz sand underlaid by loam. The investigations during a ten-year period revealed variations in the amounts of nutrient elements brought to the soil surface by defoliation, these variations depending upon the age of the forest stand and the weather conditions. The participation of the root excretion products and dying parts of the roots in the biological circulation were studied. The relation between the elements accumulated during the operation of the biological circulation and their removal by the eluvial process combines in such a way that, under the cover of an oak forest and in the described circumstances, it leads to an increase not only of humus and nitrogen, but also of the gross content of Al, Fe, Ca, Mg, P, Cu, V, Mn, Ba, and Sr in the upper part of the soil profile. It was established, first, that the upper part of the profile was enriched with loamy particles, and secondly, that there was a considerable increase in the cation absorption capacity, a high degree of base saturation, and a weakly acid active reaction.

RENDLE, B. J. *See* PHILLIPS, E. W. J.

RENDLE, BERNARD J. Forest Products Research Laboratory, Princes Risborough, England. *Changes in Anatomical Structure with Age.* The gradual changes that have been observed in the anatomical structure of wood in passing from the centre of the tree outwards have been regarded as an age effect. These changes tend to be especially marked in wood near the pith, which has been referred to as juvenile wood. Some species normally exhibit a fairly rapid change over a limited number of growth rings and thereafter show only minor variations presumably due to the influence of external factors. In others the pattern of development is quite different. Changes in anatomical structure with age or distance from the pith may have an important effect on the technical properties of the wood. The factors responsible for these changes in structure are discussed and the possibilities of control are considered.

RENNERFELT, ERIK. The Forest Research Institute, Stockholm. *Fomes annosus Root Rot: Present Status and Future Needs.* European conifer forests are in many locations severely attacked by root rot, *Fomes annosus.* In Sweden the annual loss in decayed spruce wood (*P. abies*) has been estimated at 12 million dollars. Root rot development depends on many factors, such as age, composition, and history of the stand. Moisture conditions and parent material of the soil also are of great importance. Extermination of the disease and prevention of attacks in healthy forests are the main fields of activity. Planting methods, thinning operations, and other measures of management are discussed. Currently, it seems impossible in stands that are infected to eradicate the fungus by applications of chemical compounds, etc. Conversion of severely attacked stands by introduction of more resistant species is recommended. Treatment of stumps immediately after the first thinning in stands not yet infected may prevent or control the disease.

RENNIE, PETER J. Petawawa Forest Experimental Station, Chalk River, Ontario. *Some Long-term Effects of Tree Growth on Soil Productivity.* On a typical, nutrient-poor moor podzol in Britain, various afforested sites, supporting stagnating tree growth, were compared with adjacent unplanted moor. Some seventy years' growth of both hardwoods and conifers suppressed the natural moor vegetation — predominantly *Calluna* — and brought about important structural changes within the upper, particularly raw humus, horizons. The proportion of free-draining pores was greatly increased and conditions of poor aeration were no longer present. The characteristically thin, hard ironpan had softened, and there were substantial increases in the amounts of total and exchangeable calcium in the top foot of the profile. Offsetting these improvements, there was a marked increase in the thickness of raw humus — especially under conifers, and an increase in the already intense acidity of the mineral horizons. In addition, there were decreases in the already very small, exchangeable-base and reserve-calcium contents of the deeper horizons, apparently brought about by the relatively high nutrient uptake of the tree crop. Continued satisfactory tree growth on soils of this poverty calls for preserving the improved structural condition in the upper horizons and preventing the decline in calcium status in the lower horizons.

RESCONICH, EMIL C. University of Notre Dame. *Heat-induced Susceptibility and Thermal Injury.* The effect of supra-optimal temperatures on the susceptibility of bean leaves to infection with tobacco mosaic virus (the Yarwood effect) was investigated. The period of heating required to obtain the maximum number of lesions on bean (*Phaseolus vulgaris* L. var. Great Northern) at various degrees of temperature between 40° and 55° C. was determined. When these values were plotted on a graph of the logarithm of time against the reciprocal of the absolute temperature, a straight line resulted. The slope of this line may be interpreted as equivalent to an activation energy of 80 calories. The dosages involved affect the rate of starch formation by the chloroplasts. The dosages for optimum starch formation are identical to those for maximum lesion size and number when the leaves are inoculated within an hour after heating. If the heat treatment is prolonged, there is complete cessation of photosynthesis, and, after more extensive heating, permanent thermal injury results. When the minimum time necessary to bring on these effects is plotted as above, the lines for all four processes are parallel within a certain range. The significance of these findings will be discussed.

RESENDE, F. University of Lisboa. *The Place of Gibberellin and Auxin in Flower Induction.* The discovery of gibberellin has not made it necessary to change our theoretical explanation of "flowering induction" (Resende, 1953). On the contrary, it has provided us with a suitable apolar growth substance that allows confirmation of that explanation. The use of the growth substances known before was inadequate to prove the theory in many plants, perhaps owing to the great number of inhibitors, whose action varies according to the auxin concentration. The effect of gibberellin on flower formation in SD-LD- and LSD-plants fits our scheme of 1953 for the action of auxin (= growth substances in general) on such plants. We must now reconcile this interpretation with the known facts of transmission of the floral state (not floral impulse) from scion to stock, and vice-versa, between SDP and LDP, and between LSDP. These refer to grafting of scions and stocks with leaves (Resende, 1955). This transmission shows at first sight that something specific must exist in the floral state; but we must keep in mind that a vegetative state can also be transmitted from the vegetative partner to the floral one. Also, a parasite can counteract the floral impulse received by the host, rendering the latter vegetative (Resende, 1953). Does there also exist something specific which is responsible for the vegetative state; or is this state due only to a lack of something existing in the floral state; or else can the difference between the vegetative and the floral be attributed to a quantitative difference in the hormonic level only?

RESENDE, FLAVIO. Faculdade de Ciencias, Lisbon. *On the Heredity of Ripeness to Flower, Photoperiodism, and Mutations affecting Flowering.* Crosses between species with different long periods of ripeness to flower and belonging to different photoperiodic types (SDP, LDP, LSDP, SLDP) of *Aloë* and *Kalanchoideae* were undertaken. In F_1 we have found, for ripeness to flower, types of intermediary heredity and of full dominance of the parent which flowers earlier. The F_2 has shown a very complex segregation, which points to polygeny as the genetic background. Polyploidy has also been effective, sometimes, for the ripeness to flower. Crosses between SDP × LSDP, LDP × LSDP, and SLDP × LSDP have shown in F_1 dominance of SD over LSD, but this dominance changes in LSD over SD under conditions of low light intensity. Dominance of LD over LSD and dominance of LSD over SLD has been observed in other cases. The F_2 has not yet been studied and in some cases has not been obtained on account of the sterility of the F_1 plants (*Bryokalanchoë*). Some spontaneous mutants have been found concerning inflorescence development, and form and pigmentation of flowers.

REYNOLDS, HOWARD C. Ft. Hays Kansas State College. *The "Major Blade Unit" of the Leaves of Selected Species of the Andropogoneae.* The "Major Blade Unit" is defined as that cross-sectional area of the leaf blade of grasses contained between the mid-points of adjacent major veins, and occurring in the wings of the blade outside the midrib area when the latter is well defined. A comparison of the size and structure of intercalated veins is given, and the relation of the bulliform elements to the vein categories noted. The grasses for this study were collected at the *Andropogoneae* Nursery at Oklahoma A & M College at Stillwater. The similar environmental conditions of a common transplant garden served to minimize the environmental variations which occur in diverse natural habitats. This paper presents one facet of an investigation currently in progress to determine patterns of leaf-blade venation as well as other anatomical and morphological data. Other investigators are working on the cytology, taxonomy, and plant-breeding aspects of the grasses from this nursery.

REZAK, RICHARD. Shell Development Company, Houston, Texas. *Paleozoic Evolution of the Dasycladaceae.* A re-examination of Paleozoic Dasycladaceae in the light of recent discoveries indicates that Pia's concept of the evolution of the family is in need of modification. Critical studies of the development of vegetative features, particularly the nature and arrangement of the rays about the axial stalk, in Ordovician, Silurian, Carboniferous, and Permian Dasycladaceae require significant differences in interpretation. Pia believed that none of the Paleozoic species possessed rays having an orderly arrangement in definite whorls and that this characteristic appeared suddenly and universally in the Triassic. However, the genera *Cyclocrinites* (Ordovician), *Coelosphaeridium* (Ordovician), *Primicorallina* (Ordovician), *Verticillopora* (Silurian), and *Mizzia* (Permian) exhibit verticillate rays that have an orderly arrangement. The genus *Primicorallina* is further characterized by rays that are branched into second- and third-order divisions. The idea that these fossils show a simple progressive evolution is not valid. At least as early as Ordovician time, certain members of the family exhibit advanced characteristics that have been previously considered by Pia and others to be restricted to Mesozoic and later Dasycladaceae.

RICHARD, L., et J. F. LEVY. Institut de Recherches du Coton et des Textiles Exotiques, Paris, et Laboratoire Coopératif de Diagnostic Foliare et de Biochimie Agricole, Montpellier, France. *Application du diagnostic foliaire au contrôle d'essais de fumure minerale sur contonnier par la méthode des variantes systema-*

tiques. L'interdépendance des éléments participant à la nutrition minérale du cotonnier a été mise en évidence au cours des dernières années en Afrique sur les stations de l'Institut de Recherches du Coton et des Textiles (I.R.C.T.). Cette interdépendance est particulièrement nette entre N-P et S. La méthode des variantes systématiques du Homes a été adaptée à l'étude des fumures minérales, cette méthode donne toute son importance à la notion de concentration relative des éléments dans la fumure. Il n'y a donc pas opposition entre ce mode d'investigation et les notions classiques de physiologie. La concentration relative optimum déterminée expérimentalement entre deux éléments n'est pas différente du point critique obtenu en appliquant la loi du minimum de Liebig. Ces deux points ne sont que deux aspects particuliers d'un phénomène plus général qu'est l'interdépendance des éléments. Les analyses foliaires montrent que cette interaction ne se situe pas à l'absorption, les éléments sont absorbés en quantité proportionnellement à leur apport ou tout au moins l'apport d'un élément ne modifie pas l'absorption des autres dans un sens négatif. La composition qualitative de la feuille reflète mieux les variations du rendement. Quel que soit le lieu d'expérimentation il parait possible de mettre en évidence la constance des rapports N/P et N/S correspondants respectivement aux rendements maxima obtenus lorsque l'on fait varier les concentrations de N et P ainsi que de N et S à l'intérieur d'une somme constante.

RICHARDSON, S. D. University of Aberdeen. *The Effect of Night Temperature on Tracheid Size and Wood Density in Conifers.* Experiments are described in which seedlings of *Pseudotsuga menziesii, Sequoia sempervirens,* and *Picea sitchensis* were grown under a range of different day and night temperatures, in a controlled environment, and over a period equivalent to a complete growing season. In all species, wood density and cell-wall thickness increased with night temperature, but revealed no consistent relation with day temperature or rate of growth. Very little pith was formed in any treatment and there was no measureable variation across the ring in cell-wall thickness or lumen diameter. Tracheid length, however, increased with increasing temperature, day or night, and appeared to vary according to the extent of intrusive growth. It is suggested that cell elongation and cell-wall thickening are subject to distinct physiological control, elongation being a relatively direct function of temperature, while cell-wall thickening is determined by net assimilation rate. A hypothesis, based on observed changes in net assimilation rate with age, is proposed to account for differences in density between so-called juvenile and adult wood.

RICHARDSON, S. D. University of Aberdeen. *Some Root-shoot Interrelationships.* The development of the concept of root-shoot correlation will be briefly reviewed. Dependence of the root system of higher plants on the shoot system may be envisaged in at least two respects — dependence for carbohydrates and dependence for accessory growth factors. The present paper is concerned only with the former. The nature of competition for photosynthates between root and shoots is complex. It varies with plant species and, within a species, with stage of development. This variation will be illustrated by reference to *Acer saccharinum* and *Quercus borealis maxima.* Root-shoot growth relationships are mediated not only by the level of carbohydrate synthesis, however, but also by the rate of translocation, in which temperature plays an important part. Some physiological and anatomical effects of differential shoot and root temperatures and differential day and night temperatures of seedlings of *Acer saccharinum* and *Picea sitchensis* will be described.

Ridley, M. F. Queensland Institute of Medical Research, Brisbane. *The Saprophytic Occurrence of Fungi Causing Chromoblastomycosis.* The principal species causing chromoblastomycosis are: *Phialophora verrucosa, Cladosporium pedrosoi, Cladosporium carrionii,* and *Cladosporium compactum.* The saprophytic existence of all but *C. compactum* has been established by their isolation from wood by various workers. There are no records of the isolation of any of them from soil. The methods of collecting and processing the material from which *C. carrionii* was isolated in Queensland are mentioned, and the criteria employed to distinguish between pathogenic and non-pathogenic strains of *Cladosporium* are discussed. The type of country in which chromoblastomycosis occurs in Queensland is defined, with particular reference to the area where the fungus was isolated from fence-posts. Collections were made in other types of country also, and the findings are discussed in relation to the distribution of the disease.

Riecken, F. F. *See* McComb, A. L.

Riley, Herbert P. and T. R. Bryant. University of Kentucky. *Preliminary Studies in the Identification of Species by the Paper Chromatography of Fluorescent Compounds.* Root tips from seeds freshly germinated in sterile petri dishes were squashed onto chromatographic paper and dried overnight. After two hours equilibration, descending chromatograms were run using butanol:acetic acid:distilled water as the solvent. The chromatograms were dried, heated 48 to 72 hours at 103°C., examined by ultraviolet light (3,680 Å) and the tracks compared. Tracks of different species were noticeably different, whereas those from different root tips of the same species were identical. For example, six seedlings of *Watsonia wilmaniae* gave the same picture but a different picture from seedlings of *W. ardernei.* The possibility of using this method to aid more conventional taxonomic methods in determining species differences especially in difficult genera is indicated by the different pictures obtained for *Watsonia wilmaniae, W. ardernei, W. pyramidata,* and *W. fourcadei,* for *Leonotis leonurus* and *L. nepetaefolia,* and for *Coleus barbatus* and *C. pentheri.* Tracks for *Carpobrotus edulis, C. quadrifidus, Lithops kuibisensis, L. elisabethae, L. vallis-mariae, L. fulviceps, L. divergens, Cheiridopsis peculiaris, C. pillansii, C. purpurea, Delosperma uniflorum, D. sutherlandii, D. mahonii, Aridaria primulina,* and *A. notha* in the Ficoidaceae were different but were not very clear since the roots are very small and thin.

Ringoet, A., et C. Myttenaere. INEAC, Yangambi, Congo Belge. *Etude de l'évapotranspiration de plantes cultivées dans la région équatoriale.* Une installation approprice a permis l'étude de l'évapotranspiration des plantes de riz, de maïs et de soja cultivées dans des conditions culturales normales. Les variables suivantes ont été considérées: doses d'engrais, fluctuation de la réserve hydrique du substrat pendant les différents stades physiologiques. Les données d'évapotranspiration journalière ont été mises en relation avec les facteurs climatiques suivants: radiation globale journalière en cal. g. par

cm.^{2}, température moyenne journalière en °C. et déficit de saturation en millibars. Il en résulte que: des plantes de maïs saines, ayant reçu des doses croissantes d'engrais, évapotranspirent des quantités d'eau très semblables; les plantes de riz cultivées dans un substrat qui se dessèche progressivement continuent à évapotranspirer avec la même intensité que des plantes en substrat saturé et ce, jusqu'à épuissement de la plus grande partie de l'eau disponible; par contre, des plantes qui ont subi un premier dessèchement du substrat évapotranspirent ultérieurement à un niveau d'évapotranspiration moindre. Le soja ne réagit pas de cette façon. Le coéfficient de corrélation est le plus élevé entre l'évapotranspiration et la radiation; la regression entre l'évapotranspiration et les facteurs climatiques est linéaire.

Ritchie, J. C. University of Manitoba. *Mapping the Major Zones of Vegetation in Northern Manitoba.* The aim of this work is to determine with accuracy the boundaries of the major vegetation zones of that portion of Manitoba which lies north of the fifty-sixth line of latitude. Field studies in six supposedly representative areas have provided the basis of descriptions of the vegetation and have made possible the use of vertical aerial photographs in mapping the entire region. Keys for the identification of vegetation on the photographs have been drawn up for the areas, and their extended use has facilitated the mapping. The display presents the results of the mapping, the vegetational characteristics of the zones and the "keys" to the vertical aerial photographs. Aerial and ground photographs are used to illustrate the points.

Rivalier, Emile. Hôpital Saint-Louis, Paris. *Relations hôte-parasite dans les dermatophyties.* Les interactions survenant entre les Dermatophytes et l'organisme parasité représentent un vaste sujet pathologique que nous pouvons seulement esquisser en essayant de montrer les incidences qu'elles peuvent avoir sur la taxinomie de ces champignons. Nous envisagerons d'abord les caractères communs de leurs aptitudes végétatives dans l'hôte avec les particularités dépendant des espèces envisagées, puis les caractères très constants que prennent ces parasites dans leur hôte. En contre-partie on fera apparaître les conditions de réceptivité de l'hôte et ses modes de réponse très variables à l'aggression parasitaire. Cela nous conduira à envisager les réactions antigène-anticorps et à exposer brièvement le mécanisme de l'immunité trichophytique. Nous essaierons de montrer en terminant comment on peut — du point de vue nosologique —séparer schématiquement les Dermatophytes en deux groupes. Les uns sont parasites accidentels, agressifs mais mal acclimatés, bons producteurs d'antigène et générateurs d'immunité; les autres sont des parasites acclimatés, peu agressifs mais tenaces et épidémiques, mauvais producteurs d'antigène et non immunisants. Or l'expression botanique des premiers est presque toujours riche, tandis que chez les seconds elle est plus ou moins rudimentaire ou nulle; dès lors l'étude parasitaire sera précieuse pour leur assigner dans la taxinomie une place probable que la botanique ne peut leur donner.

Robbins, William J. New York Botanical Garden. *Juvenility in Trees and Shrubs.* In their normal ontogeny from seed to flower many kinds of plants, both tender and woody, evidence more or less well-defined juvenile and adult stages which are distinguished by difference in leaf shape, production of pigment

(anthocyanin), phyllotaxy, leaf abscission, ease of rooting of cuttings, thorniness, habit of growth and flowering. A striking feature of the phenomenon is that both the juvenile and the adult state may be transmitted in vegetative propagation. The apical meristems are the sites in which the stages originate. Juvenility appears to be an unstable metabolic state which proceeds through a series of steps to the relatively steady state of the adult meristem. The steady state of the adult may be reversed toward juvenility by treatment with cold, X-rays, gibberellic acid, severe pruning, products from the juvenile state, formation of adventitious meristems, formation of nucellar embryos, and by sexual reproduction. It is suggested that the two kinds of meristems differ in possessing particular metabolites which determine the metabolic systems responsible for the differences in physiology and morphology.

ROBERTS, LORIN W. University of Idaho. *Histochemistry of Protein-bound Sulfhydryl Groups in Coleus Wound Meristems.* Protein-bound SH groups were histochemically identified by a diazo-coupling reaction with 2,2′-dihydroxy-6,6′-dinaphthyl disulfide (DDD) and by a mercaptide-forming reaction with 1-(4-chloromercuriphenylazo)-naphthol-2 (RSR). Although the region of cell division (dedifferentiating pith parenchyma) showed a low SH content at the onset of cell division, SH increased in these cells to a maximum by the end of six days following wounding. Wound xylem elements (redifferentiating pith parenchyma) demonstrated high SH at the onset of the formation of secondary wall reticulations. Experiments were conducted on the formation of wound meristems in decapitated *Coleus* plants. Results obtained with wounded decapitated plants, fed physiological concentrations of IAA, SH inhibitors, and cysteine, will be discussed.

ROBERTS, OLIVER M. University College, Cork. *Effects of Maleic Hydrazide on Translocation of Fluorescein.* Maleic hydrazide (MH) reduced the rate of translocation of fluorescein and P^{32} from the leaves of *Cucurbita, Begonia,* and *Pelargonium.* The rate of translocation fell to a minimum four to six days after spraying with MH. Recovery took place during the following four weeks and was more rapid in *Cucurbita* and *Begonia.* These results may be explained by the anatomy of the petioles.

ROBERTS, R. H., and B. ESTHER STRUCKMEYER. University of Wisconsin. *The Nature and Activity of a Flower-inducing Extract.* It has been demonstrated that flower induction in several species of short-day plants is associated with lipid physiology. A crude extract has been isolated from *Xanthium* which induces flowering. This extract is lipid in nature. When this extract is used on plants of *Xanthium* growing in long days, blossoms are induced. It appears to be interspecific. Minute quantities of this extract are required for optimum induction.

ROBERTSON, D. S. *See* ANDERSON, I. C.

ROBERTSON, R. N. C.S.I.R.O., Australia. *Cell Wall, Membranes, and Cytoplasmic Particles in Absorption.* Change in concentration or composition of salts outside a plant cell results in diffusion through cell walls and cytoplasm. Movement in walls occurs rapidly, in cytoplasm more slowly and into the vacuole only very slowly. These differences in times of equilibration are associated with differences in diffusion constants for ions in different regions of the cell and raise the problem of membranes of different permeabilities. As different regions of the cell contain ions, many of which are immobile anions, adjustments to change in external concentration of salts set up new Donnan equilibria by cation exchange. The Donnan equilibria attained affect such physical properties of the cytoplasm as the potential difference between inside and outside and the osmotic pressures and volumes of the different regions. Within the cytoplasm, different regions come to equilibrium at different rates. Mitochondria, for instance, have considerable resistance to ion movement (probably due largely to their external membranes). Membranes in the endoplasmic reticulum, where they occur, would also restrict ion movement. These physical characteristics of the living cell will be considered as preliminary to the other papers on ion uptake and movement by protoplasm.

ROBERTSON, R. N. C.S.I.R.O., Australia. *The Concept of Apparent Free Space.* The concept of apparent free space, due to Briggs, was first mentioned in print by Hope and Stevens (Austral. J. Sci. Res. (B), *5:* 335-443, 1952); definitive accounts were given by Briggs and Robertson (Ann. Rev. Plant Physiol. *8:* 11-30, 1957) and by Briggs (New Phytologist *56:* 305-324, 1957). The "free space" of a cell or tissue is that part into which solutes can move relatively freely. Since this space cannot be measured unless its properties relative to the measuring system are known, "apparent free space" (A.F.S.) is measured. A.F.S. $= U/C$ where U is the estimated amount of free space uptake of a solute by a cell or tissue from a solution of concentration C. In some plant cells, the cytoplasm may contribute to free space which certainly contains injected intercellular spaces and cell walls. The concept is valuable not only in relation to where the quick-adjusting free space occurs in the cell but also in relation to the properties of wall and cytoplasm, each containing fixed anions and mobile cations. The concentration of anions affects osmotic pressure, volume, potential differences, and times of adjustment of the Donnan part of the free space.

ROBBINS, WILLIAM J., and ANNETTE HERVEY. New York Botanical Garden. *Light and Formation of Basidiospores by Poria ambigua.* Exposure of *Poria ambigua* to visible light reduced growth and was necessary for the formation of basidiospores on a basal agar medium of mineral salts, casein hydrolysate, various purine and pyrimidine bases, and B vitamins. The extent of the response depended upon the particular fungus isolate, treatment of inoculum, age of culture when exposed, wavelength of light, culture medium and temperature of incubation. The fungus is extremely sensitive to light. A pinhole in aluminum foil used to wrap dishes incubated in daylight was adequate for spore production. The red end of the visible spectrum was not effective. Isolates varied in potency. Basidiospores were not formed on nutritionally rich media unless growth of the colony was locally partially inhibited. Chilling inoculum on colonies to 5-9°C. during exposure to light did not affect the response. The effect on spore production was evidenced by new mycelium which grew in the dark during 12 ± hours after exposure to light. We suggest that the formation of a substance or substances for the differentiation of vegetative mycelium into hymenium and basidiospores is initiated by exposure of the mycelium of *Poria ambigua* to light. The stimulus is transmitted to mycelium formed in the dark and is neutralized by vigorous vegetative growth.

ROBINSON, EDITH. Leeds University. *Effect of Temperature on Growth and Acid Phosphatase Activity in the Bean Root.* Bean seedlings have been cultured with roots placed in aerated water at 10°C., 20°C., and 30°C. for 24 and 48 hrs. After treatment, fifteen 1.0 mm. sections have been cut from the apex of the root backwards and on corresponding groups of sections estimations have been made of water content, dry weight, and acid phosphatase activity. By dividing the per-section values by the number of cells in each section, values per cell have been obtained. Length of meristem and elongating zone varies with experimental treatment. Phosphatase activity per cell increases during growth and falls when growth ceases, in all treatments. Enzyme level, dry weight, and volume per cell decrease with increasing temperature. Enzyme activity per unit volume in the mature cell at any temperature is the same.

ROBYNS, WALTER. Jardin Botanique de l'Etat, Bruxelles. *A propos de travaux monographiques.* Parmi les ouvrages de botanique systématique, les monographies détaillées, spécialement celles de familles et de genres, constituent des mises au point de toutes les connaissances à une époque déterminée, qui sont appelées à servir de base pendant un certain temps, à toutes les études ultérieures. Elles ne peuvent se faire utilement que dans des instituts possédant les matériaux d'étude et la documentation indispensables, à savoir dans les grands herbiers du monde. Or, de nos jours, la plupart de ces instituts sont engagés activement dans la préparation et la publication de flores régionales et locales, aussi bien pour les pays des régions tempérées que pour ceux des régions intertropicales. De ce fait, les travaux monographiques ou même les travaux de révision ont été de plus en plus négligés et, actuellement, les systématiciens manquent de travaux monographiques de base récents pour beaucoup de familles végétales. Cette situation, qui ne manquera pas de s'aggraver, rend très difficile la préparation même des flores. Aussi, nous paraît-il indiqué d'appeler l'attention des directeurs responsables des grands herbiers du monde, sur la nécessité de consacrer au moins une partie de leur activité à des travaux monographiques ou du moins à des révisions de familles et de genres, indispensables aux progrès, non seulement de la systématique, mais encore de toutes les branches de la botanique.

ROMANOV, I. D. Academy of Sciences, Novosibirsk, U.S.S.R. *The Embryo Sac and Pollen Morphology in Tulipa.* In the genus *Tulipa* five types of embryo sacs are known: Fritillaria, Drusa, Adoxa, *Tulipa tetraphylla*, and Eriostemones. The primitive type of the embryo sac among *Tulipa* and Lilioideae is the Fritillaria-type, which is characteristic of the most ancient genera of this subfamily. The pollen morphology in *Tulipa* is also not homogeneous: two types of pollen are found – the monosulcate and one which can be named trisulcate. The latter has one distal and two lateral furrows which are placed perpendicular to the polar axis of the pollen grain. This type is the secondary alteration of the monosulcate one which is primitive for Lilioideae. These different types of embryo sacs and pollen are distributed among the subgenera of *Tulipa* in the following way. In *T. heterophylla*, belonging to the subgenus *Orythya*, the

Fritillaria-type and monosulcate pollen are found. *T. uniflora, T. heteropetala,* and *T. edulis* have also monosulcate pollen while their embryo sac has not yet been investigated. Among Leiostemones, *T. hissarica, T. praestans,* and T. *ferganica* have the Fritillaria-type as well and monosulcate pollen. All the other species of Leiostemones are characterized by trisulcate pollen, but can be divided in groups by the type of embryo sac. The Fritillaria-type is found in the following species: *T. hoogiana, T. ingens, T. fosteriana, T. alberti, T. greigii, T. micheliana, T. maximoviczii, T. lehmanniana, T. kaufmanniana, T. gesneriana,* and *T. praecox*; the Drusa-type in *T. korolkovii, T. rosea, T. wilsoniana,* and *T. chrysantha*; the Adoxa-type in *T. ostrovskiana* and *T. kolpakovskiana*; *T. tetraphylla*-type is found in the species whose name it received. For the whole subgenus Eriostemones, the peculiar embryo sac of Eriostemones-type and monosulcate pollen grains are very characteristic; they were observed in *T. bifloriformis, T. dasystemon, T. patens, T. tarda, T. sogdiana, T. regelii,* and *T. hageri.*

Roper, J. A. The University, Glasgow. *Genetic Recombination as a Factor in Modifying Antibiotic Production.* Biochemical genetics has shown that the chemical composition and the biochemical activities of an organism are determined by its genotype. Environmental effects may alter the biochemical pattern but only within the limits of the potentialities dictated by the genotype. The genes exert their effects through the determination of biologically important macro-molecules, such as enzymes; mutation in a gene results in the loss or modification of a specific molecular species. Mutation alone has been profitably used in changing the potentialities of fungi for antibiotic production. However, mutagenic agents produce mutations of all kinds at random and a programme of strain improvement based solely on mutation is severely limited. Until recently no process of gene recombination was known in the imperfect fungi. The discovery of fungal parasexual processes (heterokaryon formation, mycelial fusion of genetically unlike nuclei, isolation of diploid strains, recombination and segregation by mitotic crossing-over and haploidisation) has provided a substitute for a standard sexual cycle in certain imperfect species. This allows a programme of deliberate breeding; it makes possible the elucidation of the genetic control of antibiotic synthesis and permits the planned breeding of improved strains.

Roper, J. A. The University, Glasgow. *The Steps in the Parasexual Cycle.* Parasexual is a term introduced by Pontecorvo to describe those processes of genetic recombination which do not take place through the standard sexual cycle of alternating nuclear fusion and meiosis. In certain, perhaps all, filamentous fungi, rare but regular fusions of pairs of haploid nuclei occur in the mycelium. The resulting diploid nuclei are relatively stable and their descendants may be included in conidia. When, in a heterokaryon, genetically unlike nuclei fuse, the resulting heterozygous diploid conidia can, by appropriate techniques, be readily selected and diploid strains established. During the growth of diploid strains the nuclei undergo rare but regular processes which result in recombination and segregation. Extensive comparisons in *Aspergillus nidulans* between the results of the sexual and parasexual cycles have clarified the parasexual mechanisms. The fungal parasexual cycle (heterokaryon formation, fusion of genetically unlike nuclei, mitotic crossing-over, haploidisation) provides a substitute for the sexual cycle in certain imperfect fungi. The parasexual cycle has implications for imperfect species in nature; in the laboratory the cycle can be used both to study the genetics of imperfect fungi and as an additional tool in the genetics of those species with a perfect stage.

ROSLYCKY, E. B., O. N. ALLEN, and ELIZABETH MCCOY. University of Wisconsin. *Characterization of Bacteriophages of Agrobacterium radiobacter.* Nineteen phages of *Agrobacterium radiobacter,* isolated from sewage and soil, cross-lysed host strains, some pathogenic species of the genus and certain rhizobia. Four phages were selected for further study on the basis of host specificity. Plaques of these were clear, without halos and with definite edges. Differentiation by cross-resistance patterns was not successful. Antisera for the selected phages cross-neutralized all phages. Some antisera gave higher K-values with homologous than with heterologous phages. Adaptations to heterologous hosts brought about serological modification of certain phages without affecting host specificity. The phages differed in percentage of adsorption, latent period, and burst size. The phages required divalent ions for multiplication; EDTA, citrate, and phosphate were inhibitory. Ultraviolet-inactivation curves showed upward concavities. Phage resistance to heat was higher in saline (0.74 per cent NaCl, 0.11 per cent $CaCl_2$) than in nutrient broth and distilled water. Protection was a function of NaCl:$CaCl_2$ ratio; each salt by itself had little effect. Optimum pH ranges were on the alkaline side; the phages were stable up to pH 11. Storage of filtrates at 4°C. for 400 days did not result in significantly lower titers; at 37°C. inactivation occurred within 15 to 50 days.

ROSS, IAN K. Yale University. *Fruiting in the Myxomycetes.* The initiation of fruiting is discussed briefly. The development of fructifications is discussed in detail. Sporangial development occurs in one of two ways. In the majority of species the hypothallus forms on the upper side of the fruiting plasmodium and the stalk is formed by the thickening of this hypothallus on the outside of the sporangial primordium. The capillitium, if present, originates after the stalk has formed. In the Stemonitaceae, the hypothallus is formed under the plasmodium, the stalk is formed as an intra-protoplasmic secretion inside the primordium, and the capillitium is a direct outgrowth of the maturing stalk. The resemblance of this method to the development of the sporangia of *Ceratiomyxa* is discussed briefly. The events occurring in the maturing sporangium, capillitium formation, meiosis, and cleavage, are discussed with particular reference to the timing of the various processes.

ROSS, PHILIP. U.S. Geological Survey. *Microclimatic Variations in a Deciduous Forest, Lower New York State.* A two-year study of the vegetation and microclimate of the hilly Harvard Black Rock Forest, Cornwall-on-Hudson, New York, was completed in August 1957. Ten microclimatic stations were installed in the Forest to measure the effect of vegetation, soils, and topography upon the temperature and its vertical stratification, relative humidity, precipitation, soil moisture, and soil temperature. Analysis of temperatures and relative humidity variations of the ten sites in the Forest is made by comparing the data obtained from the sites with the data from the flat, unforested Stewart Air Field, eight miles north of the Forest. Vegetation and elevation of the Forest are the major factors contributing to the lower weekly minimum temperatures, higher relative humidities, higher weekly maximum temperatures December through April, and lower weekly maximum temperatures April through November. Vegetation and slope aspect contribute to the differences of temperature and relative humidity among the ten sites.

ROTH, INGRID. University of Heidelberg. *Histogenesis and Morphological Interpretation of the Grass Embryo.* As a result of the reduction of one cotyledon the grass embryo has been found to derive from dicotyledonous forms; heterocotyledonous embryos, for example, those of *Triticum,* constitute transitions between the monocotyledonous and dicotyledonous types. Thus the scutellum, essentially consisting of the leaf base, represents the first cotyledon; a rudimentary ligula is recognisable on the border between upper leaf and leaf base. The epiblast must be considered as a second rudimentary cotyledon. The coleoptile is not an appendage organ of the scutellum (ligula) but represents the first cataphyll of the plumula. The internodium between the cotyledons and the coleoptile, hitherto erroneously defined as "mesocotyl," is an epicotyl. The apical growth of the coleoptile, which differentiates first on the *Triticum* embryo, is brought about by two-edged subepidermal and later by epidermal initials. The growing point is produced by periclinal segmentation of surface cells. It later on shows a one-layered tunica. A subepidermal cell, dividing periclinal-anticlinally, differentiates into the corpus initial. The scutellum grows by means of subepidermal cells according to the three-cell rhythm; the dorsal outgrowth on the scutellum originates from a dorsal meristem, while the ventral meristem gives rise to the ligula. The epiblast first grows like foliage leaves with epidermal apical initials according to the two-cell rhythm. The foliage leaves exclusively originate from the epidermis. The coleorhiza represents an organ formed by the hypocotyl. Though scutellum, epiblast, and coleoptile show different modes of growth, they nevertheless follow the general rules of leaf growth, and therefore, according to their histogenesis, may be considered as independent leaves.

ROTH, WILLY. J. R. Geigy S.A., Bâle, Suisse, et Faculté des Sciences, Strasbourg. *Réaction des Graminées aux herbicides du groupe Triazines.* L'électivité s'exprime dans tout le comportement des plantes étudiées: réaction de croissance, résistance à l'effet toxique; celles-ci varient avec les groupes systématiques et même à l'échelle du génotype monofactoriel (par exemple pour le maïs). L'action phytotoxique se manifeste par l'arrêt de la photosynthèse; la mort des plantes résulte d'une part d'inanition, d'autre part d'intoxication du fait que la photo-oxydation de la catalase est accélérée. Le mécanisme de la résistance à la 2-chloro-4,6-bis-éthylamino-sym. triazine (Simazine) est le suivant: (1) dans l'ensemble, les plantes sont protégées ou sensibilisées par l'activité de diastases d'oxygénation: Catalase et peroxydase: les plantes sensibles sont celles qui montrent une forte activité catalasique (la plupart des Hordeae); la résistance, ou plutôt la non sensibilité, est assurée par une grande activité du système peroxydase-polyphénols (groupe des Maïdeae); (2) une résistance active caractérise le maïs: en plus de la protection par le système diastasique, il possède un pouvoir d'inactivation directe de la Simazine.

ROTHMALER, WERNER. Institut für Agrobiologie Greifswald, Germany. *Alexander von Humboldt.* In commemoration of the hundredth anniversary of the death of Alexander von Humboldt, the life and works of this famous plant geographer are discussed. The lecture will be illustrated with numerous lantern slides.

ROTHMALER, WERNER. Institut für Agrobiologie, Greifswald, Germany. *Some Principles of Phylogeny and Their Application.* The following will be discussed: the species as fundamental unit; the higher taxons and the natural hierarchy; the concept of categories and the hiatus; the unity of descendence; differentiation and organization; phylogeny and the natural system; the divisions in the modern system of classification of the organismic world.

ROTHSTEIN, ASER. University of Rochester School of Medicine and Dentistry. *The Functions of Cell Membranes.* The primary function attributed to the cell membrane is the regulation of the flow of substances into and out of the cell. The regulation may take several forms: (*a*) the membrane may act as a resistance to diffusion, the resistance depending primarily on the physical properties of the diffusing substance. The net rate of movement in this case depends on the membrane resistance and on the concentration gradient (classical permeability). (*b*) The membrane may possess receptors with which substances can combine in a stereo-specific manner, gaining rapid entry by a mechanism not clearly understood. The rate of movement depends on both the concentration gradient and the kinetics of combination with the membrane receptor (specialized permeability). (*c*) Finally, the membrane may possess specific receptors linked to a source of metabolic energy, so that substances are moved uphill, against the concentration gradient (active transport). Other functions of the membrane have not been so thoroughly investigated. These include the binding of ions, and the activities of membrane-bound enzymes in the splitting or in the synthesis of extracellular substances. The definition of the membrane in terms of its physiological or biochemical functions is operational, not structural. However, certain inferences can be made concerning molecular structure.

ROUANE, PIERRE. *See* DE FERRÉ, FRANÇOISE YVETTE

ROWE, JOHN STANLEY. Federal Forestry Branch, Ottawa. *A Common Platform for Forest-type Classification.* The various approaches to forest-type classification result naturally from differences in purpose, which shape the various scales and criteria of classification and, to some extent, the techniques and methods used in the collection and analysis of data. As differences in purpose will always exist, it does not seem that any one scheme will prove universally adequate. It ought to be possible, however, to find common ground in an underlying rationale, and toward this end, it is suggested that the significant forest entities are ecosystems rather than phytocoenoses only, that they are by nature inter-grading rather than discrete, that there is therefore a subjective element in the definition of their boundaries, and that the abstract types into which they can be classified are necessarily artificial categories whose justification lies in their usefulness relative to defined ends. Particular attention is paid to the phytocoenose in relation to the ecosystem, and it is concluded that the former is an incomplete expression of the latter. A scheme to provide a geographic framework for the classification of ecosystems, based on relative size of area-of-uniformity of observable components of the landscape, is briefly outlined.

Rowley, John R. University of Minnesota and Swiss Federal Institute of Technology. *Fine Structure of the Pollen Grain Wall in the Gramineae.* Electron micrographs of pollen grains from several representative tribes in the Gramineae are presented. Emphasis is on development of the exine and intine from meiosis II through maturity. Other features described are: the boundary region between the exine and intine, subdivisions of the intine, and relation of the tapetum to the developing pollen grains.

Rubin, Boris Anysymovich. Academy of Sciences, Moscow. *The Role of Oxidative Enzymes in the Ripening and Storage of Fruits.* There is ample experimental evidence at present showing the important role which is played by physiological functions individually and the metabolic processes as a whole in the adaptation of the plant organism to environmental conditions. This role is due to the fact that any process in the plant cell can be realized not in one but, as a rule, in several ways, whereby each way is associated with certain enzymatic systems. This can be exemplified by the process of respiration. Its single links are catalyzed by a number of enzymes which differ in the degree of sensitivity to temperature and oxygen pressure and to the toxins of microorganisms, etc. When studying the oxidative apparatus of fruits, the correlation between its different elements was found to be an unstable one. During the life of the fruits the correlations between metalloproteids and flavine enzymes, as well as those between iron and copper containing oxidases, undergo regular changes. Certain shifts are to be found in the correlation between different dehydrogenases. Finally, the distribution of the enzymes between single elements of the protoplast also does not remain constant. These changes are very important for the adaptation of fruit respiration to environmental conditions which undergo changes in the course of fruit development. The above-mentioned changes play an important part in the process of ripening, in the fruit resistance to infections and physiological diseases during the storage period.

Rudolph, Emanuel D. Wellesley College, Massachusetts. *Evolutionary Specialization in the Lichen Family Teloschistaceae in North America.* The *Teloschistaceae*, a most natural family, is recognized by having spores that are polaribilocular in almost all taxa, by having parietin which reacts with KOH to give a reddish color in many of the thalli and all apothecia, and by having endobasidial spermatial formation. If one attempts to place the nine North American genera into a phylogenetic system based upon morphology, certain evolutionary tendencies can be postulated. The unicellular spores and crustose thalli of *Fulgensia* and *Protoblastenia* relate the former to the Lecanoracean line and the latter to the Lecideacean line. From *Protoblastenia, Blastenia* with its bilocular spores, can easily be derived. Further specialization can be found in those species having Lecanoracean apothecia. These taxa can be separated into genera in order of increasing specialization: *Caloplaca,* those that are crustose and lack lower cortex; *Gasparrinia,* those with lobate crustose or subfoliose thalli with lower cortex; *Xanthoria,* those with foliose thalli with lower cortex and well-developed rhizinae; and *Teloschistes,* those with fruticose thalli. The genera

Polycauliona, with its terminal apothecia, and *Speerschneidera*, with its 4-celled ascospores, can be seen as highly specialized fruticose offshoots from the main evolutionary line. Distributional patterns substantiate this proposed evolution within the family.

RUGGERI, CECILIA. *See* MESSERI, ALBINA

RUNECKLES, VICTOR C. *See* MICHELINI, FRANCIS J.

RUSSELL, G. *See* BLACKLER, HELEN

RUSSELL, NORMAN H. Grinnell College, Iowa. *Species Affinities in the Stemless Blue Violets.* Primarily through the study of herbarium specimens and large numbers of population samples taken in the midwestern and eastern parts of the United States, hypotheses have been developed concerning the recent evolution of the members of the subsection *Boreali-Americanae,* section *Nominium,* genus *viola.* This group is composed of approximately 28 recognized species. Owing to close morphological overlap and the effect of considerable natural hybridization, specific and subspecific differences have been obscured and misinterpreted. Detailed range maps will be presented, as well as clinal data. A new taxonomic interpretation of the subsection *Boreali-Americanae* will be proposed.

RUTISHAUSER, A. University of Zürich. *Pseudogamous Reproduction and Evolution.* Pseudogamous reproduction differs from autonomous apomixis in two characteristic features that are of importance for evolution: (i) it is mostly facultative, and (ii) it retains some features typical of sexual reproduction (induction of the development of the endosperm). Most pseudogamous species still form haploid egg cells or unreduced egg cells capable of fertilization. In addition it is found that the degree of sexuality is easily and considerably enhanced by crosses between sexual and apomictic species (*Ranunculus*) or between facultative apomicts (*Potentilla*) or by doubling the chromosome number of apomicts (*Potentilla*); thus segregation and recombination may take place even in progenies of those species which exhibit a high degree of pseudogamy. The production of new variants may, however, be reduced by hybrid inviability due to failure of endosperm development. As our experiments show, there exist between various subspecies of *Ranunculus auricomus* sterility barriers similar to those found in sexual species. In $4n \times 2n$ and $2n \times 4n$ crosses, for example, development of the endosperm breaks down; as a rule no viable seeds are produced. This might be the reason for the absence or at least the scarcity of triploids in pseudogamous species complexes, whereas parthenogenetic species frequently show their maximum on the triploid level.

SACHET, MARIE-HÉLÈNE. U.S. Geological Survey. *Vegetation of Clipperton Island.* Clipperton Island (10° 17′ N, 109° 13′ W) is one of the few islands, and the only coral island, in the eastern third of the Pacific Ocean. Its vegetation and flora were first studied in detail in August 1958. Except for a few groups of coconut palms, which are known to have been introduced at the end of the nineteenth century, its vegetation is low and made up of herbaceous plants, including a few suffrutescent species. When the vegetation was first observed, in August 1825, it consisted of "a little shrubbery and some coarse grass," a description which could fit its present aspect. In 1861, however, all trace of vegetation had disappeared and the island remained so for several decades. The plant cover re-established itself during World War I, or some time after. The reasons for these curious changes can only be conjectured. A feature of other coral islands, and an unusual one in the tropics, found on Clipperton, is the existence of vegetation types made up of only one species. This is probably a reflection of the extreme environmental conditions and the small flora (26 phanerogams). The principal types in terms of area are a mixed herbaceous vegetation, and pure stands of *Ipomoea pes-caprae, Heliotropium curassavicum, Conyza bonariensis,* and of several sedges. The only woody vegetation is of small groves and isolated individuals of *Cocos nucifera.* Some of the otherwise bare areas are covered by one or two mosses. The coral sand, pebbles, and boulders are stained gray by microscopic blue-green algae. In the nearly fresh lagoon are beds of *Ruppia, Naias,* and *Potamogeton.*

SACKSTON, W. E. Canada Department of Agriculture Research Laboratory, Winnipeg. *Sunflower Rust (Puccinia helianthi) in the Americas.* Sunflower rust (*Puccinia helianthi* Schw.), first described in southeastern United States in 1822 and since reported throughout North, Central, and South America, has caused heavy losses in many commercial plantings. The method by which sunflower rust spread throughout the Americas and other continents is unknown; local dissemination occurs by wind-borne spores. Chemical control of rust is possible but not usually economic. Resistant varieties provide effective control. Two non-allelic factors for rust resistance derived from *Helianthus annuus* from Texas have been incorporated into sunflower lines singly and in combination. Other resistance factors occur in other strains of *H. annuus* and in *H. argophyllus.* The use of the "Texas factors" has permitted differentiation of four pathogenically distinct rust phenotypes, which can differentiate genotypes within phenotypically similar hybrid sunflower populations. All rust phenotypes distinguishable with the "Texas factors" have been collected in Manitoba. Two of the phenotypes were identified from Argentina and Uruguay, and one from Peru; one phenotype from Argentina was further differentiated using resistance factors from *H. argophyllus.* Dangerous phenotypes were identified from British Columbia and Mexico. Perennial *Helianthus* spp. in North America, and *Wedelia* spp. in South America, may prove significant in dissemination of sunflower rust and in production of new pathogenic strains.

SADASIVAN, T. S. Madras University. *In vivo Changes in Fusarium Wilted Cotton.* Fusaric acid detection as a vivotoxin has helped in understanding cotton wilt. Infected cotton showed characteristic vein-clearing symptoms and fluorescence in ultraviolet light (3,560 Å) acropetally and histologically, destruction of plastids resulting in chlorophyll reduction. Pathogenesis resulted in over-all increased conductivity, accumulation of calcium, magnesium, and manganese, but a heavy loss in potassium, indicating ionic imbalance. While this was characteristic of the diploid ($2n = 26$) suscepts, only a slight disturbance was noticed in resistant tetraploid ($2n = 52$) cottons, indicating an obvious yet incipient cellular change in the latter. Increased ascorbic acid content, decreased reducing sugars, and augmented respiration during peak pathogenesis were recorded. Nitrogen metabolism studies revealed the presence of cystine in tetraploid cotton emerging as a resistance factor. Diploid cottons recorded higher pectin in roots, unlike tetraploids, and thereby offered substrate for the action of the twin enzymes, pectin methylesterase and polygalacturonase, of *Fusarium vasinfectum*, at the site of infection. Zinc altered cotton susceptibility by reducing pectin availability in roots, thus lowering enzyme activity of fungus. Zinc was a limiting factor for fusaric acid production *in vitro*.

SAGAWA, YONEO. University of Florida. *Self-incompatibility among Easter Lilies.* Eight clones of Easter lilies (*Lilium longiflorum* cultivars Ace, Creole, Croft, Estate, Floridii, Georgii, LWQ Australian 38, U.S.D.A. 44) have been found to be self-incompatible but cross-compatible. Examination of longitudinal sections of self-pollinated styles which average 10-12 cm. in length indicate that the pollen grains which germinate traverse only the upper 3 cm. Thereafter, no additional growth in length occurs. The rate of pollen-tube growth during the first 16 hours is the same as in a compatible pollination, but at approximately 18 hours after pollination there is a sharp divergence in the rates of growth – incompatible pollen-tubes are slower and are completely arrested after 36 hours. Since the pollen tubes develop even from an incompatible pollination, experiments are in progress to effect fertilization by shortening the style. Cutting the style approximately 2 cm. from the ovary, followed by self-pollination on the cut surface, have resulted in a limited number of viable seeds. Studies of the role of the stigmatic fluid in the processes of pollination and fertilization indicate that there is a substance present in this fluid which promotes the germination of the pollen grain.

SAGAWA, YONEO. *See* MEHLQUIST, GUSTAV A. L.

SAGER, RUTH. Columbia University. *Studies of Molecular Biology in Chlamydomonas.* This paper will summarize results of a number of correlated genetic, biochemical, and electron microscopical studies designed to probe relationships of molecular structure, mode of formation, and biochemical function of cytoplasmic organelles, especially chloroplasts and mitochondria. A wild-type strain of the unicellular sexual green alga *Chlamydomonas reinhardi* has been investigated under a variety of growing conditions and compared with several mutant strains derived from it. For example, striking changes in chloroplast morphology were found in mutants with reduced amounts of photosynthetic pigments. Although the volume occupied by the chloroplast, as a fraction of total cell volume, remains unchanged, the surface area of membranes within the chloroplast was found to be quantitatively related to, and probably controlled by, the chlorophyll concentration, and independent of the concentration of carotenoids. Consistent quantitative alterations in size and number of mitochondria per cell, and in the endoplasmic reticulum, were found in these nonphotosynthetic mutants in comparison with the wild-type strain. These and other results will be discussed in terms of current hypotheses of formation and function of these organelles.

SAGER, RUTH. *See* MARFEY, CHARLOTTE

SAKSENA, H. K. Government Agriculture College, Kanpur, India. *Effect of Soil Moisture on Host-Parasite Relations of Pythium Damping-off of Pea.* Waite Institute soil, South Australia (field capacity 22.5 per cent moisture), carries a natural infestation of *Pythium* species, particularly *P. debaryanum* Hesse, which cause damping-off in peas. The pre-emergence rotting of wrinkled seeded Greenfeast peas increased significantly with increase in soil moisture above 13.5 per cent. At high moisture level the seeds were most susceptible during the first 24 hours after planting. Presoaking of the seeds in water for 12-24 hours increased emergence by 40 per cent, by removing water soluble substances that stimulate *Pythium*. Similar diffusion took place in soil at moisture levels above 16 per cent which made the seeds susceptible. Increase of inoculum in soil failed to increase the disease incidence at lower moisture level. Thus the effect of soil moisture on this host pathogen complex was primarily on the host susceptibility factors. Increasing soil moisture had no effect on smooth-seeded White Brunswick which remained resistant since it lacked the stimulus for the flare-up of *Pythium*. However, when grown with Greenfeast at 20 per cent moisture, it suffered heavy rotting, the former providing the necessary food base for the parasitic vigour of *Pythium*. This further emphasizes the importance of nutrition in the parasitic adaptation of *Pythium*.

SALE, P. J. M., and DAPHNE VINCE. University of Reading. *Duration of Irradiation as a Factor Affecting the Response of Internodes to Wave-Length.* Studies of the effect of wave-length on internode elongation have shown the existence of two light-controlled reactions, the relative effectiveness of which may vary according to the duration of irradiation. With short periods of daily irradiation, red light (600-700 mμ) was more effective than blue (400-500 mμ) in reducing final internode length. With longer periods of irradiation two types of response were observed. In *Pisum sativum* "Meteor" the red effect was maintained at all irradiation times up to continuous illumination, but in *Tropaeolum majus* "Double Orange Gleam" the relative effectiveness of red and blue radiation was reversed, blue being more effective than red for all times longer than ± 1.5 hours per day. Time/intensity reciprocity was not exact in these responses particularly in *Tropaeolum* where, at intensities ranging from 1500 to 8000 ergs. $cm.^{-2}$ $sec.^{-1}$, intensity had little effect and blue was always more effective than red after irradiation times of ± 1.5 hours. The effects of near infra-red radiation were also investigated. In both species, whereas the effect of red light (4 hours per day) was almost completely reversed by subsequent exposure to infra-red, the effect of blue light was only slightly reversed. Experiments with four tall and two dwarf varieties of *Pisum* have shown that in the two dwarf varieties red light was always most effective, and that in the four tall varieties blue light was more effective at longer irradiation times, as in *Tropaeolum*. Possible mechanisms will be briefly discussed.

SALISBURY, FRANK B. Colorado State University. *Metabolic Approaches to Flower Induction.* The metabolic approach to flower induction utilizes treatment of whole plants with chemicals or study of plant components as a function of floral induction. Work with whole plants may be considered in relation to a system of component processes, primarily as worked out with the cocklebur (*Xanthium pennsylvanicum* Wall.). (1) Energy substrates (Liverman and Bonner) or reducing agents (Lang) will replace the high intensity light requirement. (2) Time measurement during the dark period is inhibited (slowed) by cobaltous ion, and this effect may be reversed by sulfhydryl protectors (Salisbury). (3) Synthesis of flowering hormone during the last part of the dark period may be inhibited by respiration inhibitors (2, 4-dinitrophenol (Salisbury)); cyanide, azide and fluoride (Nakayama), or by certain nucleic acid inhibitors (Salisbury and Bonner). The inhibition by 5-fluorouracil is reversed by orotic acid but not by thymidine or uracil. Low temperatures or high CO_2 levels may also influence this phase of the flowering process (Nitsch, Campbell). (4) Auxin applied during translocation of flowering hormone inhibits subsequent flowering. (5) Floral development is inhibited by a number of compounds including maleic hydrazide and 2,2-dichloropropionic acid (Salisbury). Examples of the biochemical approach include application of radioactive CO_2 and subsequent search for labeled metabolic products.

SAMEJIMA, K. *See* KURABAYASHI, M., *et al.*

SAMISH, R. M. Hebrew University, Rehovot, Israel. *Zinc Nutrition in Horticultural Practice.* The choice of both rootstocks and varieties of apple will be affected by availability of zinc in the soil in view of the great differences in feeding power. Foliar analysis showed a close correlation between zinc content and grape yields, and an even closer one with the zinc/alkali-metal ratio. The level of leaf magnesium was raised in bananas by increasing the zinc supply. The occurrence of little leaf in apples caused by zinc deficiency was affected both by severity and by date of pruning. Zinc sprays assisted in breaking the rest period. The supply of zinc to mother-vines affected both the take and the quality of grafted cuttings. Zinc also improved the rooting of olive cuttings. The use of zinc in dressings increased the rate of healing of wounds. These phenomena can be partly explained by the role of zinc on auxin synthesis.

SANDO, W. J. *See* POWERS, H. R., JR., *et al.*

SANFORD, WALLACE G. Pineapple Research Institute of Hawaii. *Diagnostic Techniques Used for Determining the Fertilizer Requirements of Pineapple Plants.* The advantages and limitations of soil analyses, plant analyses, and deficiency symptoms as diagnostic techniques will be discussed. The pineapple crop log will be presented in more detail, including methods used in its development, analytical techniques, sampling errors, and interpretation. The importance of measuring limiting factors that can and cannot be controlled will be emphasized.

SANWAL, B. D. University of Delhi. *Mechanism of Action and Metabolism of the Toxins.* Toxins in this paper are considered to mean those chemical substances other than enzymes, which are produced by various phytopathogens *in vitro* and which have also been either demonstrated to be elaborated *in vivo* or for which reasonable proof exists that they are implicated in the development of the disease syndrome. The main toxins dealt with are fusaric acid, produced by *Fusarium lycopersici*; α-picolinic acid and piricularin produced by *Piricularia oryzae*; victorin, produced by *Helminthosporium victorae*; and the wild-fire toxin produced by *Pseudomonas tabaci.* The metabolism of the toxins *in vivo* is not well understood in many diseases, but some information is available with regard to fusaric acid. Carboxyl-C^{14}-fusaric acid introduced in tomato shoots is partly decarboxylated, whereby a still more toxic substance, perhaps 3n-butyl pyridine, is produced. N-methylation and amidation of the carboxyl group leads to the formation of a non-toxic quarternary ammonium base of fusaric acid, N-methyl fusaric acid amide. The amount of detoxication of fusaric acid is correlated with the resistance of the different varieties of tomato plants to disease. Dilute concentrations of victorin and piricularin cause a great increase in the respiration of susceptible oats and rice plants respectively. The mechanism of this increase is perhaps correlated with the induced increase of polyphenoloxidase in rice and ascorbic oxidase in oats. The significance of fusaric acid and α-picolinic acid injury is perhaps correlated with their chelating power and disturbances in the water permeability of host cells.

Sapozhnikov, D. I., Z. M. Eidelman, N. V. Bazhanova, and O. F. Popova. Academy of Sciences, Leningrad. *On the Mode of Interaction of Chlorophylls with Carotenoids.* As has been shown previously in our laboratory, the two xanthophylls, lutein and violaxanthin, undergo definite interconversion. When leaves are exposed to light, the amount of lutein increases and the amount of violaxanthin decreases; in the dark the reverse process is observed. The difference in content between the lutein and the violaxanthin attains a minimum value, which is characteristic for a given plant. The dark reaction is strictly inhibited by anaerobiosis, whereas the light one is not inhibited. Hydroxylamine strongly inhibits the light reaction in the xanthophylls' interconversion; this proves that they take part in the oxygen transfer during photosynthesis and supports the suggestion that the nature of this reaction is enzymatic. Special experiments have shown that the xanthophylls' interconversion occurs in red light, which is not absorbed by the carotenoids. This proves that in the living plastids the light absorbed by chlorophyll is used in carotenoid reactions. In conclusion, we suggest that the fact of energy transfer from chlorophyll to carotenoids may be added to the known fact of energy transfer from carotenoids to chlorophyll.

Sarkany, S. University of Budapest. *Histogenesis of the Flower in the Umbelliferae and the So-called "Inferior" Ovary.* Along with preliminary studies on 25 genera of this family, the histogenesis of the flower of *Foeniculum vulgare* Mill. has been thoroughly examined. The study of sections made of flower primordia at different stages of development has established the following. In the reproductive shoot apex the flower parts develop successively. Floral leaf primordia are initiated separately, but after some time their development proceeds congenitally, a common base is evident not only within each separate flower part but for all three floral organs. Simultaneously, the peltate growth of the two carpels produces the two uniovulate locules of the ovary inside the three uniformly developing flower parts. At this stage it can be clearly observed that the zone of the reproductive shoot apex underlying the level of the flower primordia (the future receptacle) does not take part in the above-described development of flower and ovary. Thus, the morphological level where petals and stamens arise cannot be considered as a typical node. This statement is supported by the fact that it is from the congenitally developing leaf bases of the three floral organs that the ovary wall of homogeneous structure is formed and further that the ten main bundles of the wall supply alternatively petals, stamens, and pistil, showing a uniformly arranged system which can be followed back downwards nearly to the base of the ovary and which is supposed to be the result of bundle fusion; thus none of the bundles could be qualified as of axillary value. Immediately below the base of the ovary appears the level where the ten main bundles cross into the vascular system of the receptacle. On the basis of the above and other details it is suggested that in *Foeniculum vulgare* Mill., as well as in other related genera of the same structure, the ovary shows no trace whatever of being sunk into the receptacle.

SATO, A. *See* ISHIDA, KIICHI

SATO, KOICHI. National Institute of Agricultural Sciences, Japan. *Effects of Growth and Fruiting on Leaf Composition of Citrus Trees.* (1) In order to clarify effects of growth and fruiting on the mineral composition of leaves, two experiments were carried out by the common pot culture and the sand culture of Satsuma orange trees. (2) The content of N or P in leaves was affected more by shoot growth than fruiting. When a defruited tree had very vigorous shoot growth, N or P content of leaves was lower than that of a fruit-bearing tree. (3) Fruiting affected more the K content of leaves than the N or P content of leaves. The K content of leaves was lowered by fruiting. Degree of lowering of the K content increased in proportion to the amount of fruit. Decrease of the K content of leaves by fruiting is considered to be due to the depression of K absorption of the tree and translocation of K into fruit from leaves.

SATÔ, SYÔITI. *See* WADA, BUNGO

SATOO, TAISITIROO, and KEN'ITIROO NEGISI. University of Tokyo. *Experiments on the Effects of Soil Moisture on Photosynthesis of Conifer Seedlings.* The effects of decreasing soil moisture on photosynthesis of *Cryptomeria japonica* and *Pinus densiflora* were compared, and the effects of the conditions under which experiments are performed were studied. Photosynthesis and respiration decreased with decreasing soil moisture within certain limits. Some differences between the species were found in their responses to soil moisture above and slightly below field capacity and near the permanent wilting percentage, also in the recovery of photosynthesis after watering. These differences are thought to reflect silvical and ecological characteristics of the two species. Though the general trend was similar for experiments made in different years and under different conditions, there were sizable differences in details among them, especially between those made under "field" conditions and under "controlled" conditions. This suggests that much caution is necessary in evaluation and comparison of the results of independent experiments which are made on various kinds of trees. There was no evidence of any decline in the rate of photosynthesis during several hours of experiments under constant conditions, irrespective of soil moisture conditions. Light intensity affected the influence of soil moisture on photosynthesis conspicuously, the effect of deficient soil moisture being greater under strong light.

SAVILE, D. B. O. Canada Department of Agriculture. *Evolution of Saxifragaceae from a Mycologist's Viewpoint.* In the rust genus *Puccinia* there is an established evolutionary trend from teliospores that germinate *in situ* (with firm pedicels, smooth walls thickened apically, and germ-pores at the top of each cell) to spores that serve as dispersal agents (with deciduous pedicels, sculptured walls without apical thickening, and often depressed germ-pores). Such a series of rusts occurs on Saxifragaceae, enabling us to arrange the hosts in an approximately chronological sequence. The most primitive rusts occur in eastern Asia, suggesting that the family arose there. Migrants pushed across the Bering Strait to radiate strongly in the North American Cordillera. Returning migrants pushed back to radiate in and about Japan. *Saxifraga* spp. later pushed again into North America, into the Himalayas, and finally into the European mountain systems, giving rise to progressively more advanced species. To a considerable degree the morphological characters of the genera reflect dispersal mechanisms adapted to the habitats in which the genera have evolved. The processes discussed are demonstrated by maps, charts and diagrams.

SAYRE, GENEVA. Russell Sage College, Troy, New York. *Priority of Publication of Names of Musci, 1801-1821.* Contemporary reviews and announcements were used to determine the sequence of publications describing Musci in each of the years from the starting point, 1801 to 1821. Some cases of supposed simultaneous publication of new names are discussed, and subjects needing further investigation are pointed out. Copies of the lists of dated publications are available from the author.

SCAGEL, ROBERT F. University of British Columbia. *A Synthetic Approach to Some Problems in Marine Algal Ecology.* It is suggested that a critical review is needed to ascertain the present status of knowledge, to clearly establish the objectives being sought, and to evaluate the methods being used in marine algal ecology. A synthetic analysis is proposed to reassess some of the fundamental problems facing marine algal ecologists. This approach emphasizes the need for concurrent physical-chemical studies of the environment to establish hypotheses and permit adequate field and laboratory studies in order to test them. The algal distribution in the northeast Pacific is described in relation to the oceanographic characteristics prevailing along the Pacific coast of North America. Possible factors responsible for the observed distributions are evaluated and a consideration of the results of some field and laboratory studies is presented. Physical and chemical requirements, including circulation patterns, tides, temperature, salinity, oxygen, phosphate, and light, are discussed for some of the more conspicuous marine algae in the area.

SCHAEFFER, P. *See* MANIGAULT, P., *et al.*

SCHAIRER, LLOYD A. *See* SPARROW, ARNOLD H.

SCHAKHOV, ALEXANDR. Academy of Sciences, Moscow. *Photothermal Hypothesis and Plant Ecology in the North.* According to the photothermal hypothesis (A. Shakhov, 1957, 1958) plants adapt themselves to the conditions of the extreme north by developing an ability to offset the lack of heat by the use of light energy. Correspondingly, their physiological processes are modified to meet the requirements of the new way of energy utilization. Many facts corroborate this hypothesis. When the soil is cold and the air temperature continues low because the sun keeps near the horizon, the leaves of plants manage to reflect and transmit less light in the visible spectrum and the infrared so that the deficiency of heat is compensated by an increased absorption of luminous energy. Thus, photothermal adaptation is partly secured by the pigmentary "screen," which varies in density owing to the different participation of chlorophylls, carotenoids, anthocyanins, etc., in the absorption of light. Labeled isotope studies of diurnal variations in photosynthesis have shown that in the Arctic in summer the photosynthetic activity continues throughout the "night." In the hours when the sun is low over the horizon the plants have been found to make more effective use of radiant energy than during the day although in the day the rate of photosynthesis is much higher. Features characteristic of photosynthesis under these conditions are a low light-saturation threshold, a low compensation point, etc. Investigations of northern plants from the standpoint of the photothermal hypothesis will initiate an important line of research in plant ecology.

SCHEFFER, ROBERT P. Michigan State University. *Association of Disease Resistance with Host Metabolic Activities.* Circumstantial evidence indicates that resistance to *Fusarium* wilt in tomato depends on active metabolism. The fungus gradually disappears from stems of resistant plants growing under favorable conditions, but persists under such unfavorable conditions as low light. If inoculated resistant plants are treated with certain metabolic inhibitors in sub-lethal concentrations, resistance is destroyed. The dependence of resistance on active metabolism is still more apparent in potato infected by *Phytophthora infestans* and in other hypersensitive combinations. Defence toxins apparently are mobilized, possibly by energy-requiring reactions, from cells adjacent to the infection site; phenolic compounds and polyphenolase activity may be involved. In potato tissue, narcotization can prevent accumulation of phenols and expression of resistance. Some resistant tissues produce "phytoalexin," a non-specific toxin of unknown composition, after infection but not after wounding. The formation of "phytoalexin" is prevented by treatments affecting metabolism. Formation of chlorogenic acid, associated with resistance to some diseases, depends on active metabolism. Maximum accumulation of chlorogenic acid follows periods of high respiration, very little is formed in the dark, and 2,4-dinitrophenol and NaF inhibit formation. Data from Tomiyama, Müller, Fuchs, Ruckenbrod, and others are included.

SCHELPE, E. A. University of Cape Town. *Ecology of Bryophytes on Arable Fields around Oxford, England.* Bryophyte communities on the arable fields studied are mostly subjected to a catastrophic disturbance annually as a result of ploughing. These communities consist of small, largely acrocarpous mosses (usually under 1 cm. high) and a few species of small hepatics. The bryophyte populations that arise on these fields during the year subsequent to ploughing are shown to originate from previously buried, dormant spores or gemmae. The development of the populations during growth and after reaping of the covering crop is traced. These observations are correlated with gametophore production in some of the constituent moss species in experimental culture under various light intensities. In years in which summer droughts occurred the appearance of far fewer moss gametophores and a drastic reduction in the numbers of hepatics and slow-growing moss species are ascribed to differential drought resistance exhibited by the hepatic thalli and by the protonemata and by gametophores of the mosses occurring in this habitat. The effects of physical and physicochemical edaphic factors which are suspected of being operative in determining the species composition of arable field bryophyte communities are briefly discussed in relation to field observations, correlated with experiments designed to evaluate the effects of single probable factors, in experimental culture.

SCHIEFERSTEIN, R. H. *See* LOOMIS, W. E.

SCHIFF, JEROME A., HARVARD LYMAN, and H. T. EPSTEIN. Brandeis University, Massachusetts. *Studies of Chloroplast Development in Euglena by Radiation Techniques.* Ultraviolet light (UV) has been found to elicit two biological responses in *Euglena gracilis* var. *bacillaris* and in the Z strain. (1) Relatively high doses of UV result in cell death. This killing deviates markedly from first-order kinetics. (2) At sub-lethal doses of UV, chloroplast development can be completely inactivated. This inactivation is permanent since the albino progeny of irradiated cells remain chloroplast-free during subsequent transfers. However, exposure to visible light immediately after UV photo-reactivates chloroplast formation with efficiencies approaching 100 per cent. Since these observations can be reproduced with dark-grown cells (lacking chloroplasts), the presence of fully formed chloroplasts themselves is not necessary. An interpretation which serves as a working hypothesis is that there are self-replicating UV-absorbing entities in the cells which control chloroplast biosynthesis. The observed photoreactivation suggests the presence of nucleic acid as a constituent of these entities. Also, a preliminary action spectrum shows that light of 2,537 Å is much more effective for chloroplast inactivation than wavelengths of 2,800 Å and above. After UV, colonies are found with green and white sectors in addition to completely green and completely albino colonies. Such colonies could result from cells whose chloroplast-producing entities are not all inactivated, the remaining viable entities being diluted as the cells divide.

SCHLICHTING, HAROLD E., JR. Michigan State University. *A New Technique to Study the Role of Waterfowl in the Dispersal of Algae.* Ideas expressed by most ecologists concerning the dispersal of micro-organisms by waterfowl have been largely based on assumptions. Field collections were made, and a series of controlled experiments were conducted to determine the possible role played by waterfowl. Ducks were trapped and, in certain phases of the experiment, some were washed in detergent. They were then placed in a water pen for periods of time varying from 15 minutes to 24 hours. After removal from the water pen, the ducks were exposed to the air for periods ranging from 15 minutes to 32 hours by being hung on a clothesline in a harness. The ducks were then restrained in a holding funnel while plastic boots filled with sterile pond water were tied around their feet to remove any organisms present. One hundred and six waterfowl, representing seventeen species, were treated in this manner. Washings from the feet, bills, and feathers, the contents from the gullets, and faecal material as well as washings of birds collected in the field were cultured in soil-water medium. All cultures were examined microscopically to determine the presence or absence of organisms. In some instances examinations were also made of the uncultured material. Field data and the control experiments demonstrated that waterfowl can retain viable forms of algae and protozoa both internally and externally. The ducks exposed to the air for less than four hours carried a great variety of organisms. Those in the air eight hours transported some organisms on their feet, but a greater variety was found to be carried in their bills. The birds exposed to the air longer than eight hours yielded very few organisms. Chance happenings in dispersal are explainable, in part, in terms of cell morphology, reproductive structures, the nature of the dispersing agent, and environmental conditions. Not only the biological and physical nature of the aquatic environment, but also the modes of dispersal determine the organisms which are to be found in a given environment. Although often not considered, these modes of dispersal are also important in explaining the distribution of aquatic micro-organisms throughout the world.

SCHMIDT, RALPH L. British Columbia Forest Service. *Factors Controlling the Distribution of Coastal Douglas Fir in British Columbia.* Consideration is given to the manner in which direct and indirect climatic influences control the distribution of Douglas fir. Long-term successional studies indicate the indirect relationship of climate, frequency of forest fire, and Douglas fir distribution. The direct relationship between climate and the altitudinal range of Douglas fir is also considered.

SCHNEIDER, I. R., and J. F. WORLEY. U.S. Department of Agriculture. *Distribution of Translocated Particles of Southern Bean and Tobacco Mosaic Viruses after Intake into Tracheary Elements.* Published information indicates that translocatability of southern bean mosaic virus (SBMV) into and out of tracheary elements apparently differs from that of tobacco mosaic virus (TMV). Introduction of SBMV directly into hypocotyls of Pinto bean (*Phaseolus vulgaris* L.) recently indicated that it could cause infections in undamaged cells after transport in tracheary elements. Prior studies by J. Caldwell provided evidence that TMV could not do this in tomato and tobacco. The present study begins a comparison of the distribution of transported particles of these two viruses after intake into tracheary elements of the same host (Pinto bean). Detection followed introduction of these purified viruses individually into hypocotyls of intact plants and their subsequent uptake in the water stream. On the basis of the infectivity detected in extracts of samples from different parts of the plant, the results to date indicate the following. SBMV was transported upward rapidly and extensively. Infectious particles reached portions of the stem 3 feet from the point of virus introduction in a half-hour or less. SBMV was detected in petioles and leaves 6 hours after virus introduction (the shortest interval for which data are now available). Because of the short interval between virus introduction and sampling, the authors believe that they have detected transported, not "multiplied," virus. TMV, on the other hand, was not detected in leaves and petioles 6 hours after its introduction into hypocotyls. Even 24 hours after its introduction, TMV has not been detected in the stem more than 6 inches above the point of introduction. The data suggest that the two mosaic viruses studied may differ in their translocatability in the water stream of a mutual host.

SCHÖNBACH, HANS. Institut für Forstwissenschaften, Tharandt, Germany. *Die Variation der Frostresistenz in "einheimischen" Beständen der grünen Douglasie (Pseudotsuga menziesii (Mirb.) Franco).* Die Nachkommenschaften freiabgeblühter Bäume, die 1948 in drei, heute etwa achtzigjährigen Beständen im Tharandter Wald ausgewählt und beerntet wurden, zeigten bereits als einjährige Sämlinge bemerkenswerte Unterschiede in der Frühfrostresistenz. Die frühfrostharten Nachkommenschaften erwiesen sich im Verschulbeet und auf zwei

Versuchsflächen auch als winterfrosthart, die frühfrostempfindlichen Familien dagegen als winterfrostempfindlich. Die Ergebnisse der mit diesem Pflanzenmaterial durchgeführten, heute zehnjährigen Anbauversuche haben gezeigt, dass unter den gegebenen Standortsverhältnissen Früh- und Winterfrostresistenz für den Kulturerfolg in erster Linie entscheidend sind. Während die frostharten Familien heute noch hohe Pflanzenzahlen aufweisen, sind die frostempfindlichen Nachkommenschaften zum Teil bis auf die letzte Pflanze ausgefallen. Innerhalb der in den achtziger Jahren des vorigen Jahrhunderts nach Europa eingeführten Douglasienherkunft, die nach C. A. Schenck aus der Klimasektion 19 (West-Washington) stammen soll, besteht also eine breite Variation bezüglich der Frostresistenz. Frostharte Sorten lassen sich bereits durch einfache Selektionsverfahren (Massenauslese) gewinnen. Die weitere Feststellung, dass sich die frühfrostresistenten und frühfrostempfindlichen Typen an gestaltlichen Merkmalen unterscheiden lassen, ist für eine Frühauslese von Bedeutung. Untersuchungen an Kreuzungsnachkommenschaften haben jedoch ergeben, dass diese mit frühem bzw. spätem Vegetationsabschluss zusammenhängenden Merkmale modifikativen Veränderungen unterliegen.

Schopf, James M. Ohio State University. *Classification of Fossil Plants.* During our generation the most significant development in paleobotany has been concerned with plant microfossils. Fossil spores, pollen grains, cysts, other types of plant disseminules, and cuticular and vascular fragments have been found in nearly all types and ages of sedimentary rocks. Although sometimes difficult to interpret, the wealth of readily available material offers important aid to botanists as well as stratigraphers. Paleobotanists have recognized many inconsistencies in representation or preservation of fossils in rocks of various geologic ages, and this source of difficulty continues. However, the microfossil assemblages are so much more copious and generally represented than megafossils that they provide a basis for evaluating the actual incompleteness of record. Such information is needed to support inferences about the existence of early Paleozoic vascular plants. The tremendous influx of new plant microfossil information has not yet been satisfactorily integrated with knowledge of the geologic history of plants. Much work is required in order to bring the new evidence within a satisfactory system of plant classification. Modification in some venerated ideas evidently will be required in order to present this information with systematic consistency. It now seems that the origin of vascular plants is much more ancient than previously assumed, and that plants of pteridophytic evolutionary level extend into the Cambrian. This suggests that there is more time available, for evolutionary approximation of the vascular plant phylogenies back to a point of common origin, than has generally been utilized. Evidence based on microfossils contributes importantly to this conclusion. Taxonomic classification involves the summation of evidence bearing on plant relationship. However, the classification of plant fossils of all kinds continues to emphasize generic and specific categories without enough regard for the consistent arrangement of larger taxonomic groups. Major taxonomic categories represent generalizations of major importance in botany. The implications of porogamous siphonogamy, for example, relate to virtually all aspects of plant organization. This is an adequate reason for attaching more importance to major taxonomic categories in classification of fossil plants in the future. Specimens of fossil plants commonly show more features than have been used which are amenable to systematic diagnosis. Their fragmentary nature has been overemphasized. In many instances only the refinement of experimental evidence is lacking to assist in determining precise degrees of taxonomic relationship. Of course, the evidence from fossil specimens is available to us in a somewhat different context than it is from herbarium specimens and it is important for taxonomic identifications to reflect observable evidence precisely, as well as the systematic interpretations based on facts. Practical classification always should acknowledge the varying degrees of difference in available knowledge. For this reason, the systematic classification of fossil plants must differ from that based on modern material, but these differences reflect differences in organization more than they reflect the quality of knowledge.

SCHRÖCK, OTTO. Waldsieversdorf, Markisches Hohenland, Germany. *The Importance of Physiological Age for the Methodics of Forest Plant Breeding.* Numerous observations have shown that the assessment of breeding material in regard to various attributes such as growth increment, resistance, power of regeneration, and morphological characteristics, is rendered difficult by the changes occurring with advancing physiological age. Observations on cuttings of a tree of *Populus* × *berolinensis* parentage, which were obtained from water shoots of different heights, indicate the influence of physiological age. Observations on 20 selected plants, 10 large and 10 small, of a progeny from crosses with aspens revealed that plants growing very rapidly during the first year of vegetation are usually fast growing in the early stage. Consequently, they flower earlier than plants growing at a slower rate during the first year of vegetation, which have not flowered even after seven years, but have nearly caught up to the formerly faster growing individuals in growth. Fast growing in the early stage is associated with early culminating of growth and early inception of flowering. Continuous measurements of annual shoot growth provide a way of finding out whether young individuals are fast growing or slow growing during the early stage. The relations between the expression of the different characters in the early and advanced stage, which exist in the individual wood species, have to be ascertained by investigations.

SCHUBERT, BERNICE G. U.S. Department of Agriculture. *Some Aspects of the Taxonomy of American Dioscoreas.* Taxonomic studies in Dioscorea greatly depend on complete herbarium material, and must take into account the outstanding characters of the genus. Among these may be cited (1) habit of the plants, which are twining vines and often closely entwined with members of other genera; (2) dioecism, with often only slightly overlapping flowering periods of staminate and pistillate plants; (3) tubers of great size, or length, or complicated branching, very difficult to trace; and (4) mostly alate, very lightweight seeds, quickly dispersed after rupture of the capsule. Because of the collecting and propagation programs sponsored by the New Crops Research Branch, U.S. Department of Agriculture, it has been possible to supplement the original herbarium collections with photographs of tubers sent for propagation, and later with specimens cultivated at the Plant Introduction Stations, to obtain a more complete comprehension of many species. Examples of species will be presented (by slides) to demonstrate the chief distinguishing characters of most American sections of the genus, and note will also be taken of the divergent tuber characters of species with very similar floral characteristics.

SCHULTZ, ALARICH R. Porto Alegre, Brazil. *Zur Phylogenie der Sporocarpe der Marsiliaceen. Marsilia, Regnellidium,* und *Pilularia* unterscheiden sich voneinander durch die Anzahl der Fiederblätter ihrer Trophophylle. Sie bilden eine Reduktionsreihe 4-2-0. *Marsilia* dürfte in dieser Hinsicht als primitivste Form anzusprechen sein. Die Sporocarpe von *Marsilia* öffnen sich in zwei vielsorige, die von *Pilularia* in einsorige und die von *Regnellidium* in 10-14 einsorige Klappen. Jede dieser Klappen kann man mit einem fertilen Fiederblättchen von Blechnum gleichsetzen. Nur *Marsilia* fällt dabei durch ihre Vielsorigkeit leicht aus dem Rahmen. Unter dieser Voraussetzung ergibt sich eine Verschiebung des Entwicklungsrichtung bei Sporophyllen und Trophophyllen. *Regnellidium* ist am primitivsten und es folgen *Pilularia* und *Marsilia*.

SCHUSTER, RUDOLF M. University of Massachusetts. *Evolution in the Ptilidiinae.* The Ptilidiaceae s. lat. represent an ancient ensemble, divisible into at least six families (Herbertaceae, Blepharostomaceae, Ptilidiaceae, Trichocoleaceae, Isotachaceae, Lepicoleaceae). The last two families have been recently described by the author. A number of stenotypic and monotypic genera have been recently described (Herzogianthus, Chaetophyllopsis, Lophochaete), and others remain to be described. A study of this complex suggests that it forms the matrix from which there has been evolution of the Jungermanninae, perhaps three times, through the Lophocoleaceae, Antheliaceae, and Lophoziaceae, suggesting this suborder may be polyphyletic. Through the incubous-leaved members, perhaps the Ptilidiaceae, evolution of the Porellinae may have taken place. The chief bases for considering the Ptilidiinae as primitive lie in the virtual isophylly; the occasional presence of antheridia in bracteoles; the very high spore : elater ratio in some genera (e.g. *Herzogianthus*); the restriction of rhizoids to the underleaf bases; and the great diversity in modes of branching.

SCHULZ-SCHAEFFER, JÜRGEN. Montana State College. *The Cytotaxonomic Significance of the Satellite Chromosomes in the Genus Bromus L.* Twenty-nine *Bromus* species, belonging to the sections *Bromopsis, Bromium,* and *Ceratochloa* are compared cytologically in this study. The main criterion is the shape of the satellite chromosomes. Seventeen types of satellite chromosomes have been found and have been designated with roman numerals (I, II, IIa, III, IV, V, Va, VI, VII, VIIa, IX, X, XI, XIa, XII, XIII, XIV). For each of the three sections of the genus typical satellite chromosomes could be described. These are the types I, IIa, III, IV, and VIIa in section *Bromopsis*, V and XI in section *Bromium*, and II, VI, VII, IX, X, XII, and XIV in section *Ceratochloa*. Types Va, XIa, and XIII have not been found frequently in the present material. Type III was also found in three species of section *Bromium*. These species, *B. secalinus, B. commutatus,* and *B. oxyodon* might be sectional hybrids between *Bromopsis* and *Bromium*. *B. sitchensis* ($2n = 56$) is believed to be a sectional hybrid between *Ceratochloa* and *Bromium*. It possesses satellite chromosome type XI, which is typical for section *Bromium*. Of particular significance is the shape of the satellite chromosomes in section *Ceratochloa*. Their satellited short arms are all extremely short which distinguishes them from the satellite chromosomes in the other sections. A diagram indicates which species have satellite chromosome types in common. The significance of a similar analysis for other genera and for the investigation of intergeneric relationships is discussed.

SCHWABE, W. W. Rothamsted Experimental Station, Harpenden, England. *Test of a New Photoperiodic Hypothesis.* In *Kalanchoe blossfeldiana* and several other short-day requiring species it has now been shown that long days have an inhibitory effect on flowering and are not merely ineffective. Quantitative estimates show that the inhibition caused by one long day may annul the positive effects of up to two *succeeding* short-day cycles. The effect of temperature on these reactions suggests that chemical changes are involved. None of the existing theories of photoperiodism can fit these data. A new, tentative hypothesis, designed to interpret these and other results, is based on the assumption that an inhibitor is formed in long days which interacts with an adaptively formed enzyme. During induction the enzyme is assumed to increase in amount, as well as to catalyse the formation of a flower-promoting substance. From the hypothesis a lengthening of the critical photoperiod with progressive induction could be predicted. This prediction has been tested and the results of two different experiments indicate that it is correct, and intrinsically non-inductive day lengths (being too long) can become inductive when given to plants which have received some previous short-day treatment.

SCOTT, FLORA MURRAY, VIRGINIA SJAHOLM, and EDWIN BOWLER. University of California. *Light and Electron Microscope Studies of Primary Xylem.* The structure of the wall of annular and spiral vessels in the shoot of *Ricinus communis* is examined under light and electron microscopes. Expansion, thickening, lignification, and suberisation occur. The term suberin connotes fatty material resistant to H_2SO_4 80 per cent. Intercellular spaces adjacent to vessels are lined and later occluded with suberin. Vessels are lined with a tenuous film stainable with dimethylaminoazobenzene. Minute refringent droplets appear attached to the wall. Moribund vessels, isolated by H_2SO_4 maceration, are completely suberised. Xylem cells were macerated ultrasonically in order to retain cell-wall components. Fragments were mounted and shadowed. The microfibrillar pattern of procambial and vessel cells is reticular. Pits are ubiquitous. Wall thickenings arise as closely woven microfibrillar bands, one or many, in annular and spiral elements. Intercellular space linings appear granular, and occlusions are dense to the electron beam. Irradiation with full strength electron beam distinguishes younger and older cells as to degree of lignification and suberisation. Older spiral thickenings remain unchanged while the younger react explosively and become bead-like in outline. The lining of older vessels appears unaltered. Younger vessel linings sizzle violently and differentiate into a basic mesh work and a volatilised coagulum.

SCUFLAIRE, R., et G. BREBION. Institut National de Recherche Chimique Appliquée, Annexe du Bouchet, Vert-le-Petit, France. *Action d'extraits aqueux et éthérés de Triticum sativum sur la croissance et la chlorophyllogénèse de ce végétal.* Dans une étude antérieure, un des auteurs a constaté qu'il existait vraisemblablement une corrélation entre le développement du système radiculaire de *Triticum* et la chlorophyllogénèse. Des extraits aqueux et éthérés de broyats de tiges et de racines prélevés à divers stades de développement et sur des cultures obtenues dans des conditions variées de température, d'éclairement, de milieu, ont montré l'existence de plusieurs fractions actives. (1) Les extraits éthérés de broyats de tiges et de racines expérimentés dans différentes conditions semblent provoquer une faible action inhibitrice. (2) Les extraits aqueux de broyats de racines paraissent activer fortement la croissance. (3) Les extraits aqueux de broyats de tiges paraissent inhiber fortement la croissance, mais peuvent également l'exciter légèrement à une forte dilution. Les extraits obtenus sur les plantes croissant à l'obscurité sont, pour une même concentration, plus actifs que les extraits obtenus sur les plantes se développant à la lumière. L'âge des sujets ne semble pas avoir d'influence. Des essais d'isolement de la fraction active des extraits ont été tentés par séparation sur résines échangeuses d'ions. Des études biochimiques sont en cours (dosages de sucres, ac. aminés, organiques) pour essayer d'élucider le mode d'action des fractions actives et apporter une contribution à l'équilibre physiologique qui semble exister entre activateurs et inhibiteurs de croissance.

Scuflaire, R. *See* Brebion, G.

Scully, Norbert J. *See* Chorney, William

Sears, Paul B. Yale University. *The Green World of Charles Darwin.* The solemn portrait of an elderly Darwin, bearded, cloaked, and semi-invalid, gives no hint of his almost boyish enthusiasm. Like all great creative personalities, he did the thing he liked best. This he was able to do by virtue of the leisure conferred by inherited wealth. Perhaps society should be cautious in making it impossible to accumulate sufficient means for such independent service. Darwin's life and work also remind us that great accomplishment is possible without formal academic training. His preparation in science was strictly extracurricular – a good thing to note in this day of highly organized higher education. Again, Darwin, while capable of intense and specialized study, was a generalist, interested in broad fundamental relationships. Both types of mind are essential to science, but they are not often combined in one individual. It is clear, too, that while Darwin had great influence in changing his culture he was also a part of it and indebted to the currents of thought of his time. Finally, his contribution, made without thought of practical benefit, has been of inestimable value in various practical ways – a superb illustration of the value of basic research, carried on for its own sake.

Sears, Paul B. *See* Clisby, Kathryn H., *et al.*

Sebyla, T. *See* Birecka, Helena, *et al.*

Sehnem, Aloysio. Faculdade de Filosofia, Ciências e Letras Cristo Rei, São Leopoldo, Rio Grande do Sul, Brasil. *New Ferns from Rio Grande do Sul, Brazil.* Working on ferns of Rio Grande do Sul, Brazil, the author found some which do not agree with any known ones and which he is going to present as new to science.

Selleck, G. W. University of Saskatchewan. *Life History Studies of Leafy Spurge (Euphorbia esula L.).* Certain aspects of the life history of *Euphorbia esula* have been studied since 1951. More than 9,400 acres infested with *E. esula* have been located in approximately one-third of the settled area in Saskatchewan. Maximum germination of the seed occurs after one year, but some germination may occur in soil for five years. Maximum germination of the seed occurs in early spring though some may continue throughout the season. At the age of seven to ten days the seedlings produce buds on the roots and are thus capable of vegetative reproduction. An inflorescence is not produced until the second season. Patches of *E. esula* spread vegetatively from 1 to 11 ft. per year, depending upon the type of competition. Densities may vary between 200 and 1,000 shoots per square meter depending upon soil textures and the type of competition. Roots which are severed three feet below the soil surface are capable of penetrating 3 ft. of tamped soil within a period of 12 months. The paucity of forbs in patches of *E. esula*, even when bare ground is visible between shoots, suggests that this species may exhibit toxic effects on other plants in nature.

SELMAN, I. W. and R. G. MILNE. Wye College, University of London, England. *Accumulation of Tomato Spotted Wilt Virus in Tomato in Relation to Nitrogen and Magnesium Supply.* The multiplication of tomato spotted wilt virus in tomato has been studied using local lesion counts on leaf strips cut from a clone of *Petunia hybrida*. The leaf strips were inoculated mechanically using celite and a ground glass roller supported on a slow-moving turntable. In tomatoes grown in nutrient solutions at 65°F., a light intensity of 450 foot candles and a 15-hour daily light period, virus could be detected in inoculated leaves in three days and in younger systemically invaded leaves in six days. At the time of symptom appearance virus content was maximal and thereafter declined, especially in the younger leaves. In both inoculated leaves and in younger leaves becoming systemically invaded, virus content tended to increase with increasing nitrogen supply up to the level which was optimal for growth and decreased at higher levels. Magnesium supply (1.8–293.4 p.p.m.) was without effect on the virus content of inoculated leaves. An effect of magnesium on the virus content of systemically invaded leaves was noted but this was attributable to small effects of nutrient level on the growth rate of the whole plant.

SEN, S. P. Bose Research Institute, Calcutta. *Metabolic Changes in Photoperiodism: A Tracer Study.* The metabolic changes during some of the partial processes of photoperiodism have been studied by feeding detached leaves or intact plants with $C^{14}O_2$ under suitable conditions of light and darkness. Three short-day plants, *Xanthium*, Biloxi soybean, and Rupsail rice, and one long-day plant, Wintex barley, were used. Metabolic changes during dark interruption treatments with red light followed by near infrared — immediately or after different periods of dark intervals — have been studied in some detail. The products of photosynthetic $C^{14}O_2$ fixation in red and blue light applied as dark interruption treatment will also be reported. The translocation pattern of C^{14}-labeled compounds from leaves of *Xanthium* and soybean exposed to different periods of darkness has been studied. The rate of translocation is initially very slow, followed by an increase, but decreases again during the second half of the long inductive dark period. Subsequent exposure to high intensity light resulted in a sharp increase in soybean, but not in *Xanthium*. In either case, however, a large number of C^{14}-labeled compounds were formed in the leaves. Examination of the apices of Wintex barley and Rupsail rice plants fed $C^{14}O_2$ during the light period of one of the inductive cycles revealed marked quantitative changes in the C^{14}-labeled compounds. In the rice, the root system of induced plants had six times, the leaves twice, and the apices four times the C^{14}-activity of non-induced ones. Acetate-1-C^{14} metabolism of isolated apices also revealed remarkable quantitative changes. The implications of the findings will be discussed.

SENJANINOVA-KORCZAGINA, M. V. Leningrad University. *An Ecological Investigation in the Boreal Ericales.* The quest for the leading structural-biological principles determining general appearance of life forms and the factors inducing their genesis and the principal direction of this genesis is far from being completed. New facts must be accumulated concerning the interrelations between the plants and the environment and those distinctive features that are being determined now and were moulded in the geological past by site conditions as well as by the historically formed heredity. The comparative ecologico-anatomomorphological study of leaves and shoots of the boreal Ericales growing under different light and temperature conditions in natural plant communities and of those growing under uniform laboratory conditions, carried out by the author, has shown the high plasticity of the leaf structure, the changes of their so-called "xeromorphic" characters, and the reduction in the activity of the meristem of the shoot ends. The investigation of the seasonal and diurnal variations of the total water content of leaves, of their water-retaining capacity, and of the seasonal variations of starch-formation has demonstrated the lability of these physiological processes, corresponding to the structure of the leaves. The changes in the leaf structure under different light conditions are also indicative of the decisive effect of this factor. In the Tertiary deciduous forests, possessing several strata and characterized by periodical variations in the intensity of penetrating light, the Ericales could have acquired shade tolerance, that is, the adaptation to a wide range of variations of light and heat. Having retained certain features of the thermophilous Tertiary flora, the rhythms of a life cycle alien to a northern environment, the boreal Ericales at the same time show a certain degree of cryophily. However, alongside these characters, the absence of the harmonious adaptations to the adverse conditions arising in time and space is sometimes observed in the course of genesis of the principal life forms from tree to herb. Consequently the life-form development is based on the reduction in the activity of the meristem, the decrease in mass, and the changes in the character of the differentiation of the anatomo-morphological structures, on the direction of growth and on the processes of growth and development.

Seshagiri, Rao R. Botanical Survey of India, Shillong. *Comparative Studies of the Alpine Flora of the Central and Eastern Himalayas.* Our knowledge of the Himalayan flora, which was studied in general from the phytogeographical and systematic points of view, is far from complete as several tracts in Nepal, Bhutan, North-East Frontier Agency (N.E.F.A.) of India, and a few in Sikkim are still to be explored. The data presented in the paper are based on the author's studies along the region comprising the Alpine zone of high valleys and slopes between Mt. Cho Oyu (Nangpa La) and Mt. Everest in Eastern Nepal, Singalelah and Chola ranges of Sikkim and Se La and Bum La ranges of Kameng frontier division (N.E.F.A., east of Bhutan) lying between 27°25′ – 28°5′ N and 86°40′ – 92°20′ E at an altitudinal range of 4,200-5,500 m. Data collected indicate that the altitudinal limit to plant life, which practically approaches perpetual snow, varies with different regions depending on physical features and climatic factors. In general, the Alpine flora of the region under study is mostly homogeneous with species along the drier slopes of the Central Himalayas characteristically distinct from those of the more humid Eastern Himalayas though there is gradual transition in their variation and distribution. The transition proceeds *pari passu* with succession of ridges running more or less east and west. The diversity in the individual species along the various valleys is partly influenced by the presence or absence of lofty ridges with extensive alpine meadows. Distribution of the species of *Rhododendron, Primula, Meconopsis, Saxifraga, Pedicularis, Ephedra,* and a few members of Berberidaceae, Caryophyllaceae, Rosaceae, Crassulaceae, Compositae, and Gramineae in the region under study in relation to their habitat and variation is discussed in the paper.

SETTERFIELD, GEORGE, and S. T. BAYLEY. National Research Council of Canada. *The Effect of Geotropic Stress on Microfibril Arrangement in Primary Cell Walls.* With the methods developed by Boysen-Jensen, young bean stems were grown horizontally in glass tubes. Cortical cells from the upper and lower sides were compared by electron and polarization microscopy with cortical cells of normal and decapitated stems. Cells from the upper side of horizontal plants showed heavy deposition of approximately longitudinally oriented cellulose microfibrils, similar to those found in collenchyma cells. Cells from the lower side increased in diameter and deposited approximately transversely oriented microfibrils. Rotating the horizontal plants through 180° after 24 hrs. caused a concomitant change in the direction of microfibril deposition on the two sides. It is concluded that in this system the direction of microfibrillar deposition is, in part, a response of the cells to internal and external stresses which arise from differential distribution of auxin. No evidence was found for plasma papillae penetrating the walls.

SETTERFIELD, GEORGE. *See* BAYLEY, S. T.

SHAFFER, BRIAN M. Cambridge University. *Aggregation in the Dictyosteliaceae.* After consuming the available food supply, myxamoebae, previously independent, collect together to build fruiting bodies. Aggregation, basically a single morphogenetic movement, involves a relayed chemotactic attraction and increase in intercellular adhesiveness. Changes in the properties of the cells have been studied with a variety of techniques and used to define a number of developmental states during the aggregation phase. There is considerable intraspecific and interspecific variation in the sequences of these states and in the rates at which they are passed through.

SHAH, SURYAKANT S., and G. LEDYARD STEBBINS. University of California. *Stomatal Development in the Leaf Epidermis of Certain Grasses.* The development of the guard cell complex in *Hordeum, Dactylis, Ehrharta, Pennisetum, Sorghum, Zea,* and other genera of grasses is characterized by mitotic divisions asymmetrical in size and staining properties of nuclei. Initially, cells in the stomatal row give rise distally to a smaller cell with a nucleus staining heavily with Feulgen or aceto-carmine stain, which becomes the guard mother cell, and proximally to a large cell with a weakly staining nucleus. Subsequently, mitoses in cells adjacent to the stomatal row give rise to a small heavily staining nucleus adjacent to the guard mother cell and a large weakly staining nucleus at the opposite pole. The smaller nuclei form cells flanking the guard mother cell, which become subsidiary cells of the stomatal complex. After division of the guard mother cell transversely to form two guard cells, the complex elongates and differentiates. In panicoid genera, asymmetry in size and staining properties of the nuclei is more marked than in *Dactylis* and *Hordeum,* while each lateral epidermal cell rarely forms more than one subsidiary. In *Dactylis* and *Hordeum* lateral epidermal cells frequently form two or three subsidiary cells. (This research was supported by National Science Foundation Grant no. G-3737.)

Shapiro, Seymour. Brookhaven National Laboratory, Upton, N.Y. *Studies on the Control of Root Polarization on Stem Cuttings of the Lombardy Poplar.* The stem of the Lombardy poplar contains systematically arranged preformed root primordia which are produced as part of the normal pattern of development of the plant. These root initials are inhibited by light but emerge and grow rapidly if cuttings are maintained in darkness. The red–far-red reversible mechanism of growth control applies, with red light causing the inhibition. Roots will emerge uniformly all along the length of cuttings taken from trees in the dormant winter condition, but only those primordia at the base of the cutting develop into roots if cuttings are taken from trees in active growth during the summer months. This results in polarized root emergence in the summer and non-polarized development in the winter. Auxin (indoleacetic acid) completely removes the polarization found in actively growing trees. Studies of the winter-spring and summer-fall transition periods reveal that considerable new growth takes place in the spring before root polarization is initiated. Similarly, depolarization occurs some time after the cessation of growth in the fall. Experiments dealing with the relationship between polarization and daily photoperiod will be discussed. (Research carried out at Brookhaven National Laboratory under the auspices of the U.S. Atomic Energy Commission.)

Sharma, Kapil Dev. McGill University, Montreal. *Stimulating Effect of Irradiation on Buckwheat–Fagopyrum esculentum (Moench)–Silver Hull Variety.* Random samples of 50 seeds each were irradiated with X-rays (5,000 r–40,000 r) or with thermal neutrons (8.73×10^{12}–5.87×10^{13}/cm.^{2}/sec.) and planted with a comparable control sample in a uniform soil in 4 in. pots in the greenhouse and were then given uniform treatment. Observations were made simultaneously on all treatments. The data from the R_1 generation strongly indicate that 5,000 r and 10,000 r X-rays have a stimulating effect, as compared with the control, with respect to the days to emergence of the seedling, seedling height, days to the expansion of the first true leaf, days to the first flower and plant height, the latter being a highly significant difference. The same is true for the lowest dose of thermal neutrons but to a lesser degree. Higher irradiation doses have a retarding effect with respect to these characters. Percentages of seedling emergence and of plants reaching maturity were not affected by lower doses whereas they were greatly reduced in higher doses. The data from the R_2 generation, obtained only by selfing R_1 plants, show the same trends to about the same magnitude although based on comparatively smaller samples. Thus stimulation seems to be carried on to the second generation and is, therefore, heritable. This seems to be another case of phenotypically constructive polydirectional mutations induced by irradiation.

Sharp, Aaron J. University of Tennessee. *The Southern Appalachian Flora in Relation to the Phytogeography of Eastern North America.* Most of the area south of the glacial boundary and otherwise defined by the inner coastal plains and Mississippi embayment has been available to terrestrial plants since the advent of the angiosperms. Its flora, once much richer and containing subtropical elements, has been impoverished by climatic changes in the Pliocene and Pleistocene. However, the taxa still are genetically complex and highly polymorphic. Much of the floras of the newer coastal plains and still more recent, glaciated terrain to the north consist of segregates from the more ancient flora of the Southern Appalachian highlands.

SHARP, EUGENE L. *See* SMITH, FREDERICK G., *et al.*

SHAULIS, N. J. Agricultural Experiment Station, Geneva, N.Y. *Symptoms of Potash Deficiency, Plant Analysis, Growth, and Yield of Concord Grapes.* In the period 1944–58, four field trials and two vineyard surveys were conducted in the Chautauqua or Lake Erie vineyard area of New York State. Most of the work was with the Concord variety of grapes; other varieties have a similar response. It was determined that sampling could be done effectively in late August (60 to 70 days after bloom), that scoring for symptoms was best done at harvest time. In all the trials there is a complete record of pruning weight, bud number, crop weight, and cluster size. The presence of marginal chlorosis or scorch due to potassium deficiency is associated with a very narrow range in the potassium percentage of the petioles. Vine growth and yield are depressed more than would be accounted for by the loss of the affected leaf area. Acute deficiency resulted in a reduction of cluster number per shoot as well as a berry size reduction. Increases in the potassium content of the petioles above that necessary to eliminate the marginal chlorosis are not associated with growth or yield increases.

SHAW, M. University of Saskatchewan. *The Respiratory Pattern in Diseased Plants with Particular Reference to Rust-infected Leaves.* An increase in respiration is a widespread response to infection with plant pathogens. In some instances the effect extends well beyond the limits of proliferation of the parasite. With rusts and mildew the effect is sharply localized at infections and it is difficult to estimate the separate contributions of the fungus and the host. When wheat leaves are heavily infected with *P. graminis tritici*, the QO_2 increases two to three times as the parasite develops. The R.Q. remains close to 1.0, but the ratio of the CO_2 output in nitrogen to that in air falls from about 1.0 to 0.2. Measurement of the C_6/C_1 ratio suggests that the respiratory pathway is shifted in favour of the hexosemonophosphate shunt. The oxygen uptake also becomes highly resistant to malonate. This and other evidence bearing on the operation of the tricarboxylic acid cycle will be discussed. Ascorbic acid oxidase activity is increased by infection, but there is no good evidence for the suggestion that this enzyme serves as the terminal oxidase.

SHAY, J. R., and A. G. BROWN. Purdue University, Indiana, and John Innes Horticultural Institute, England. *Concepts and Problems in Disease Resistance in Tree Fruits.* Disease-resistance research in tree fruits indicates that the problems are much the same as those in annual seed-propagated crops, but they are magnified by the nature of the crop. Since tree varieties in orchard production cannot be readily or economically changed, the problem of the occurrence of physiologic races of the pathogen that can successfully attack varieties resistant to common races is of special significance. Protection against this event will be inadequate at best, but safeguards such as the use of all available sources of multigenic and monogenic resistances and continuous testing of these host resistances over a wide geographic area may be taken. Other special problems in tree fruits include the length of time required for fruiting of each generation and the resources required to secure adequate populations. These characteristics demand the development of evaluation tests of resistance that will sort out the resistant and susceptible segregates in early growth stages. This is feasible for pathogens attacking vegetative structures of the plant but not for those confined to attacks on fruits. An advantage of tree fruits is that any promising resistant individual may be propagated clonally for production without prolonged selfing to achieve homozygosity.

SHEA, KEITH R. Weyerhaeuser Timber Co., Centralia, Washington. *Dwarfmistletoe of Ponderosa Pine: Present Status and Future Needs.* *Pinus ponderosa* Laws. commonly is parasitized by two species of dwarfmistletoe, *Arceuthobium vaginatum* f. *cryptopodum* (Engl.) Gill in southwestern United States and *A. campylopodum* f. *typicum* (Engl.) Gill in western North America. The taxonomy, epidemiology, and control of these parasites are known in a general way from limited studies or analogies with other species of dwarfmistletoe. Emphasis has been placed on control primarily by silvicultural means. The most urgent future need is for a greatly broadened program of fundamental research on the ecology, biology, and physiology of the ponderosa pine dwarfmistletoes and their tree hosts. Studies of the biotic and abiotic factors influencing the life cycle and those environal factors having bearing on the spread and intensification of the parasites in forest stands are indicated. Investigations on the biology and physiology of the host-parasite relations should be stressed and include studies on nutrition, hormone, and enzyme relations, as well as investigations on the pathways of movement of materials between the host and parasite. Additional personnel adequately trained in the various fields of biological research are needed along with greatly improved research facilities in order to achieve effective control of the dwarfmistletoes on a practical basis.

SHEN, JANE Y. *See* TEUBNER, F. G.

SHILOVA, N. V. *See* KONOVALOV, I. N., *et al.*

SHKOLNIK, M. YA., S. A. ABDURASHITOV, and V. N. DAVYDOVA. Academy of Sciences, Leningrad. *Micronutrient Effect on Photosynthesis, Carbohydrate Metabolism, and Translocation of Assimilates.* Several micronutrients, especially Mn and Cu, cause a rise in the rate of photosynthesis and alleviate to some extent the depression of it in the day-time. Our investigations showed that the latter fact is closely connected with the ability of plants to increase their carbohydrate translocation and their heat resistance. As shown by special studies the promoting effect of micronutrients on the rate of photosynthesis is especially strong under conditions of high to almost critical temperatures, which inhibit the photosynthesis rate. Evidence has been accumulated, through experiments with maize, for the beneficial effect not only of B, but also of Mn, Zn, Cu, and Mo, on the carbohydrate synthesis and translocation. The last four micronutrients also increase the respiration rate and the activity of oxidizing enzymes. These results point to an intimate connection between the promoting effect of these micronutrients on the carbohydrate translocation and their beneficial effect on the energetic site of the translocation of substances. The cause of the promoting influence of B on the carbohydrate translocation lies, as it was suggested by us previously, in its ability to form complexes with carbohydrates; those complexes are likely to be characterized by their greater mobility. This suggestion is consistent with the interpretation by various authors of the physiological action of B in higher plants. The beneficial effect of micronutrients on the translocation of carbohydrates is one of the causes of the decrease in abscission of flowers and the promotion of fruit formation. As shown by the experiments with cotton plants, the increase of assimilate translocation from leaves to reproductive organs under the influence of B takes place when C^{14} assimilation goes on during hot day hours, but it is not so when the assimilation proceeds in cooler morning hours. These results indicate the cause of the raised requirements for boron supply in plants under high temperatures, previously found in our investigations.

SHKOLNIK, M. YA. Academy of Sciences, Leningrad. *Promoting Effect of Micronutrients on the Resistance of Plants to Unfavorable Conditions.* Studies in our laboratory have shown the beneficial effect of micronutrients such as B, Cu, Zn, Mn, Mo, Co, and especially Al, on drought resistance of plants, and B, Cu on their heat resistance. These researches, as well as those of various other authors, revealed to some extent the cause of the promoting effect of the micronutrients' action on the colloid-chemical plasma state, water regime of plants, carbohydrates, nitrogen, and phosphorus metabolism, oxidation-reduction, and other processes. The drought resistance promoting effect of micronutrients is especially significant with drought occurring during the periods of bud and tetrad formation, those periods being critical in regard to water supply. This fact is due to the ability of micronutrients to increase the carbohydrate translocation from leaves to reproductive organs, the translocation being inhibited by lack of water supply. The work of our laboratory indicates that Al, Cu, Zn, Mo, and Mn increase frost resistance of citrus plants, clover and cold resistance of maize, by influencing certain measurable physiological processes. A promotion of salt resistance under the influence of micronutrients, especially B and Al, was also noted. Researches of various authors have shown the ability of micronutrients to increase the salt resistance of plants only in conditions of low and middle salinity, whereas they do not affect or even decrease it in conditions of high salinity.

SHROPSHIRE, WALTER. California Institute of Technology. *Action Spectra of the Light-growth and Tropic Responses of Phycomyces.* Detailed action spectra employing null methods for both the growth and the tropic responses of *Phycomyces* sporangiophores were determined at 5 mμ intervals from 240 to 540 mμ. Maxima of effectiveness occur at 280, 385, 455, and 485 mμ for both. A comparison of the two action spectra leads to the following conclusions. (1) The photoreceptor for both responses is the same. (2) There is no appreciable self-screening by the photoreceptor. (3) In the visible the focussing effect of the cylindrical sporangiophore, which is responsible for the positive tropic response, gives the distal half an advantage of approximately 25 per cent. (4) The compensation point at 330 mμ and negative tropic response for shorter wavelengths can be explained by an internal screen, having an optical density of about 0.10 at 330 mμ and increasing rapidly for shorter wavelengths. Gallic acid is present in the sporangiophores in sufficient concentration (10 mg./ml.) to account for such a screen. (5) A comparison of the *Phycomyces* action spectra with the phototropic action spectra in *Avena* (*Avena* maxima are shifted 10 mμ to shorter wavelengths) indicates similar photoreceptors for lower and higher plants.

SHULT, ERNEST E. Southern Illinois University. *Tetrad Analysis in Yeasts and Other Fungi.* Modern genetic theory (which provides the mode of inference) in studies of segregation and linkage has provided information concerning (*a*) the location of genes and (*b*) the manner in which crossing-over occurs. Tetrad analysis of the lower plants, however, is now being exploited because the data from tetrad analysis possess more degrees of freedom, as well as other advantages, over conventional Mendelian single strand analysis. Tetrad analysis provides additional information concerning (1) three independent criteria for ordering genes (compared to one criterion by single strand analysis) providing a higher level of certainty concerning the demonstration of linear and non-linear gene orders than is available in bacterial or viral genetics, and (2) methods for the location of the centromere not possible with single strand analysis. Tetrad analysis also provides (1) a complete separation between chromatid and chromosomal interference between regions and (2) a means of detecting interference within a single region. Tetrad analysis also provides a unique type of hybrid whose total genome is derived from a single meiosis (e.g., the intra-ascal hybrid). The latter is useful for the direct genetic study of single translocations and inversions and for the study of inheritable preferentially segregating sites ("affinity").

SIDOROV, A. *See* TERENIN, A.

SIEGELMAN, HAROLD W. U.S. Department of Agriculture. *Biosynthesis of Anthocyanin and Related Compounds.* The synthesis of anthocyanin and related compounds has recently been extensively examined by biochemical, physical-chemical, and physiological methods. The probable biosynthetic pathways of these compounds derived mainly from radioactive tracer studies will be presented and enzymatic mechanisms will be suggested. The formation of the anthocyanin and related compounds either requires light or is enhanced by it. Action-spectrum studies for the promotion of anthocyanin formation in the range 4,000-8,000 Å will be presented, and the possible nature and role of the photoreceptor will be discussed. The alternative products which accumulate in darkness and their relation to the light-induced synthesis of anthocyanin and related compounds will be presented.

SIGAFOOS, ROBERT S. U.S. Geological Survey. *Botanical Evidence of Floods and Flood-Plain Deposition.* Floods — flows that overtop the banks of river channels and cross bordering flood plains — occur on the average of one year out of two. High water occurs more frequently. Debris carried by floods and high water causes tree damage, ranging in severity from bark injury to uprooting and burial. Few flood-plain trees are killed; most continue to grow producing scar tissue and sprouts that hide the damage, yet record the date of its occurrence. Some species produce sprouts only during the first growing season following a flood; other species produce sprouts almost continuously. Sprout trees are common and have been observed on flood plains in a large part of the United States. Two kinds of evidence indicate the date of high water. Age of the oldest sprouts equals the number of growing seasons since the last major flood. Physical characteristics of outer layers of wood in buried trunks differ from those of wood formed prior to uprooting and from those of wood formed subsequently in sprouts. The year of change in wood character marks the year of burial. Available hydrologic records date the events necessary to explain the differences in tree form and wood anatomy.

SIJPESTEIJN, A. KAARS. Institute for Organic Chemistry T.N.O., Utrecht. *Chemotherapy and Synthetic Systemic Fungicides.* The conventional methods of protection of plants against fungi are: breeding of resistant varieties, the application of proper cultural conditions, and the spraying of plants with a fungicide that provides them with a protectant cover. In recent years experimental research has been carried out on the development of fungicides which should enter a plant and circulate within its tissues. These systemic fungicides would offer various advantages over protectant fungicides. Many synthetic fungicides have been tested on various plants and some proved to be systemic, but none has as yet reached the stage of practical application. Also several fungicidal antibiotics have proved to be translocated in plants. Apart from these two groups, a third group deserves attention. This group comprises substances which, when applied to plants, cause a decrease of disease symptoms, whereas *in vitro* they show little or no activity as fungicides. It is believed that these substances combat the fungi indirectly by increasing host resistance.

SILBERSCHMIDT, KARL. Instituto Biológico, São Paulo, Brasil. *Cross-protection Tests between Unrelated Viruses.* In earlier papers we have shown that cross-protection tests between strains of the same virus do not always give positive results and that f.i. tomato plants harboring a mild strain of potato-virus Y still remain susceptible to an attack of a severe strain of the same virus. Continuing these studies we verified that on the other hand tobacco plants harboring a mild strain of potato-virus Y were to a large extent protected against the effect of an attack by a severe strain of the spotted-wilt virus of tomato. In this case the plant is protected by a strain of a virus which is unrelated to the challenging virus. These observations, which agree well with the results recently published by A. D. Thomson (Nature *181:* 1547-1548, 1958), demonstrate that the results of cross-protection tests only under very special conditions may be used for diagnostic or taxonomical purposes.

SILVA, M. *See* POLLACK, J. D.

SILVA, MARGARITA, and J. D. POLLACK. Columbia University. *The Microconidia of the Dermatophytes: An Aid to the Differentiation of Species.* Current taxonomic criteria for the dermatophytes are based primarily on the morphology of the macroconidia and secondarily on colony and physiological characteristics. The demonstration of these frequently requires special media and long periods of incubation, or sometimes may fail altogether. Yet the readily produced microconidia, still as characteristic for many species as when depicted by Sabouraud, have been largely neglected as a taxonomic criterion. The proposed paper, illustrated with photomicrographs will provide examples of microconidial display in several species of dermatophyte representing recent clinical isolates.

SILVA, PAUL C. *See* IRVINE, DAVID E. G.

SIMINOVITCH, D. Canada Department of Agriculture. *Frost Resistance with and without Added Synthesis of Cytoplasmic Protein in Normal and Girdled Tree Tissues of the Black Locust: Manifestations in the Nucleus and in the Phospholipids of a Duality in the Protoplasmic Mechanism of Frost Resistance in Trees.* Continued seasonal study of the association of frost resistance with protein synthesis in the black locust has further served to emphasize the important relationship of cell protein concentration to normal cell frost resistance. But while interference with translocation restricts protein synthesis and frost hardening simultaneously, it is still observed, as reported earlier, that double girdling in summer, which arrests protein synthesis completely, does not altogether eliminate hardening. Indeed, the degree of hardiness which can be developed under these conditions is considerable even with minor starch-sugar transformations. It is concluded that (1) there exist two primary mechanisms of protoplasmic resistance in trees, (2) complete hardiness requires the operation of both mechanisms, and (3) one at least of these mechanisms can operate independently of the other. Distinctive cytological and chemical features mark the combined and separate mechanisms. Normal and complete hardening in fall is associated with the radical transformation of the protein synthetic system of the cell leading to the near doubling of the cytoplasmic protein concentration in the cell. In the absence of cell growth or enlargement this is reflected in cytological changes involving increase in the prominence or visibility of the nucleus and the cytoplasm especially in fixed and stained preparations. However, nuclei of cells of girdled sections partially hardened in fall in the absence of protein synthesis exhibit similar but less pronounced changes. Increased prominence of the nucleus, therefore, is not solely a criterion of normal hardening with protein synthesis. It is also a manifestation of the subsidiary change in the protoplasm which is associated with its limited capacity to develop resistance to freezing in the absence of protein synthesis and independently of starch-sugar transformations. To some extent this change is conditioned by low temperature. At present the most promising clue as to the chemical processes involved is the change which occurs at the same time in the phospholipids. Any degree of hardening with or without protein synthesis in normal or girdled trees respectively is consistently accompanied by a change in the ease with which phospholipids can be extracted from dehydrated tissues although extractability does increase with degree to which normal resistance is developed. The possible significance of these phospholipid changes is discussed.

SIMONET, MARC. Institut Recherches Agronomiques, Versailles. *Hybrides interspecifiques amphidiploïdes d'iris.* L'amphidiploïdie (hybridation entre individus à nombres chromosomiques doublés) peut être obtenu directement par le croisement d'espèces autotétraploïdes. Les hybrides amphidiploïdes sont souvent fertiles et stables, c'est-à-dire que dans les générations successives, il n'y a pas apparition de disjonction génétique. Ce sont en réalité de nouveaux genres ou de nouvelles espèces qui sont ainsi créées et lorsqu'ils sont issus d'espèces

éloignées (sections différentes), ce sont de nouveaux types génétiques intéressants au point de vue cultural. Dans cette voie, la contribution des Iris est importante. Ils offrent de beaux exemples d'autopolyploïdie. Les Iris *Hoogiana, Korolkowi,* et *stolonifera* (Section Regelia) à $n = 22$, *pumila* et *balkana* (Section Pogoniris nains) à $n = 16$ et 24, *aphylla* et *macrantha* (Section Pogoniris grands) à $n = 24$, sont autotétraploïdes (ou se comportent comme tels) par rapport aux types dont ils sont issus à $n = 11$ (Regelia), 8 et 12 (Pogoniris). Or ces différentes espèces s'intercroisent et nous ont directement donné 14 amphidiploïdes Pogoregelia (*Stolophylla, Stolomac, Hoogphylla, Hoogiamac, Stolkana, Hoolkana,* $n = 23$; *Stolomina* et *Hoogmila,* $n = 19$), Pogoniris nains (*Pumilkana,* $n = 20$), Pogoniris grands (*Macaphylla,* $n = 24$) et Pogoniris Nains × Pogoniris grands (*Pumilmac* et *Aphylmila,* $n = 20$; *Malkana* et *Aphylkana,* $n = 24$), chez lesquels on trouve alliées certaines caractéristiques intéressantes (précocité, rusticité, floribondité). Ces hybrides, stables et fertiles, véritables espèces nouvelles, peuvent être utilisés directement au point de vue ornemental ou indirectement, comme géniteurs, dans l'obtention ou l'amélioration de nouvelles races d'*Iris.*

SIMPSON, B. *See* GORHAM, P. R., *et al.*

SIMPSON, F. J. *See* CIFERRI, O., *et al.*

SINGER, ROLF, y JORGE MORELLO. Universidad Nacional de Tucumán, Argentina. *Mycorrhizas y comunidades forestales.* El complejo "arbol/mycorrhiya ectotrofíca/hongo" se considera aqui como una unidad bioecologica que, como los liquenes, tiene amplitudes ecologicas superiores a cada uno de sus componentes aislados. Los liquenes han sido usados en biogeografía especialmente en los tipos de vegetación donde dominan (tundra, desiertos, rocosos), mientras que el complejo cormofita/hongo no ha sido estudiado ecologica- y fitosociologicamente. Los autores creen que la separación de comunidades forestales mycorrhizicas, mixtas (dominantes no mycorrhizicos) y no mycorrhizicas, permitiràn plantear bajo un nuevo aspecto, viejos problemas de fitogeografia histórica, como el origen de los bosques de *Alnus* de las montañas sudamericanas hasta ahora considerados tipicamente boreales; el limite altitudinal de los bosques, dado por comunidades no mycorrhizicas (*Rhododendron* en Asia, *Polylepis* en Sudamérica), etc. Los autores analizan los bosques mycorrhizicos de *Fagus* en el hemisferio norte y *Nothofagus* en el sur; el papel de géneros mycorrhizicos como *Quercus* en las selvas no mycorrhizicas del sur de México, la ausencia de elementos mycorrhizicos constantes en las selvas tropicales de llanura y dan una clasificación de las comunidades forestales de la Argentina en base a la associación cormófita/hongo. Además estudian el papel del componente mycorrhizico en distintos tipos de comunidades arboreas llegando a la conclusión de que el estudio unitario del complejo cormófita/hongo puede ser un excelente instrumento de trabajo ecológico y fitosociológico.

SINGH, T. C. N. Annamalai University, India. *On the Activation of Photosynthesis in Hydrilla verticillata Presl. by Sound Waves of an Electric Bell.* The growth of plants as affected by sound waves (of violin, flute, etc.) has been the subject of study in the University Botanical Laboratory since 1950, but there has been none on their metabolic process under excitation of sound. In the present investigation, a submerged water-plant *Hydrilla verticillata* Presl. was

excited by continuous ringing of an electric bell for half an hour daily and its photosynthetic value was determined in terms of volume of oxygen evolved during a particular fixed period of time. Alongside, a proper control experiment was maintained. After a series of experiments during the past twelve months, it has been found that both the rate and the total volume of oxygen evolved from sound-excited *Hydrilla* plants were appreciably much higher (to the extent of 60-100 per cent) than the control *Hydrilla* plants not dosed with sound.

Sirohi, G. S., and K. C. Hamner. University of California. *Inhibitory Effect of Long Days on the Flowering of Soybean (Glycine Max).* Soybean plants were exposed to different numbers of short days. Cycles consisting of variable length of the photoperiods under different temperature and light intensities were intercalated in between short days (donor cycles), and the inhibitory influence caused by the intercalated cycles on the floral initiation was studied. It was observed that floral initiation caused by intercalated cycles is a function of the length of the photoperiod during the intercalated cycle. Within the limits of 12.5- to 14.5-hours photoperiods, the inhibitory effect progressively increases with the corresponding increase in the length of the photoperiod in a linear fashion. Variable conditions, such as low light intensity during the photoperiod and low temperature condition during various phases of the intercalcated cycles, increase the inhibitory influence differentially. The study of the interaction between two types of cycles (donor and intercalated cycles) shows that floral inhibition seems to be due to a flowering inhibitor which is produced differentially under various conditions during the intercalated cycles. The fact that the inhibition may be due to the interference caused by intercalated cycles on the rhythmic nature of floral initiation in the plant is indicated. A tentative hypothesis to explain the results is proposed.

Sironval, Cyrille. Botanical Institute, Liège, Belgium. *Chlorophyll, Hematin, and Photoperiodic Reaction.* Radioisotope studies confirm the dependence of chlorophyll metabolism on day-length conditions. They also show that chlorophyll *b* could derive from chlorophyll *a* through a photo-oxidative process. Day length controls not only the chlorophyll content of the leaves, but also their content of other tetrapyrrolic compounds, as shown by measuring the total leaf hematin. From experiments performed with different day-neutral species, the chlorophyll/hematin ratio appears nearly constant in the adult leaf. The value of the ratio remains the same in short and long day. However, it varies with leaf ageing, being lower in the young leaf and higher in the old one. Typical long-day and short-day plants do not behave exactly like day-neutral ones. Here, the ratio chlorophyll/hematin varies also with leaf ageing, but it is definitely lower in the photoperiodic condition which induces flowering. This feature is particularly evident in the young expanding leaf. The induction of flowering by proper day length corresponds, in this leaf, to a decrease of the chlorophyll content and to a simultaneous increase of the hematin content. These facts support the idea that day length may act on flowering in regulating the content in some essential tetrapyrrolic compounds.

Sissakian, N. M., and N. A. Vasilieva. Academy of Sciences, Moscow. *Biochemical Properties of Plant Cell Nuclei.* Resting and awakened wheat germs were dehydrated by means of lyophilic drying, and cell nuclei and the cytoplasmic fraction were isolated therefrom by different methods. Isolation methods affect the biochemical properties of nuclei and the cytoplasmic fraction. Thus, in a sucrose solution, the loss of catalytic proteins results in reducing dehydrogenase activity. A loss of lipids occurs in the mixture of tetrachloromethane, toluene, and petroleum ether, which was employed in isolating nuclei according to the Behrens method. The nuclear fraction isolated by the Behrens method differs from the cytoplasmic one both in the total- and protein-nitrogen and the total- and nucleic acid-phosphorus. Irrespective of isolation technique, the cellular nuclei display cytochrome oxidase, succinic dehydrogenase and apyrase activities. The disturbance of the resting condition results in changes in the enzymatic activity of nuclei isolated from wheat germs. The most substantial changes occur in the succinic dehydrogenase activity. During germination the activity of this enzyme is increased owing to the cytoplasmic fraction, the nuclei being completely deprived of their enzymatic properties.

SJAHOLM, VIRGINIA. *See* SCOTT, FLORA MURRAY, *et al.*

SKALINSKA, MARIA. Krakow, Poland. *Cytology and Mode of Reproduction of Some Endemic Species in Relation to Their Age.* Instances of the relation between the degree of ploidy, the mode of reproduction, and the putative age of some endemic species are discussed in the light of recent results of the author, J. Malecka, M. Piotrowicz, and A. Kulczycka. *Taraxacum pieninicum* Pawl., occurring endemically only in a few habitats of the Pieniny Mts., is a diploid ($2n = 16$) sexual species with normal macrosporogenesis. Its low chromosome number and sexual reproduction point to its great age. Evidently it represents a rare survivor of a very ancient form, originally with a wider distribution. *Chrysanthemum zawadzkii* Herb. is likewise an endemic species of a relatively great age, very abundant within the area of distribution in the Pieniny Mts. It is hexaploid ($2n = 54$) with a remarkably high vitality. It is strictly sexual; contrasting with numerous species of *Chrysanthemum* which develop tetrasporic embryo sacs, it has a monosporic embryo sac of a primitive embryological type. By contrast, *Poa granitica* Braun-Bl. and *P. nobilis* Skal. among the *Gramineae* are examples of endemic species presumably of rather recent origin. Like other representatives of the section Stoloniferae they have variable, high, aneuploid chromosome numbers. The former reproduces by apospory while the latter is viviparous. Both are oreophytes of the High Tatra. In this connection the study of the chromosome number and mode of reproduction of *Leontopodium alpinum* Cass. (which is not an endemic species) deserves mention. Specimens from the Tatra Mts. are tetraploid ($2n = 52$). Their way of reproduction is unbalanced: meiosis is followed by degeneration of the macrospore tetrad and diplospory gives rise to viable embryo sacs. Such a behaviour favours the opinion of taxonomists that it belongs to rather younger species within the genus.

SKELDING, A. D., and G. R. PROCTOR. University College of the West Indies and the Institute of Jamaica. *Hill Savanna in Jamaica.* Although the former presence of savanna in Jamaica was surmised from place names, no existing example was known until Mason River swamp in Clarendon parish was investigated in 1957. This relatively natural savanna at 2,300 feet elevation comprises about 200 acres of undulating ground with impeded clay soils in the depressions capped by free-draining gray sands on the low ridges. Soil pH's lie between four and five. The vegetation is dominated by sedges in the valleys and by sedges and grasses or melastomaceous scrub on the ridges. *Hydrocotyle asiatica* forms a ubiquitous understorey and *Blechnum indicum* is widespread. Shallow pools surrounded by *Sphagnum erythrocalyx* contain *Mayaca fluviatilis* and *Utricularia* species. At the lowest level, a permanent bog about 50 cm. deep contains numerous small islands each formed round a single *Miconia* (Melastomaceae) shrub and showing a horizontally stratified ground vegetation. Two saprophytic genera, *Leiphaimas* (Gentianaceae) and *Apteria* (Burmanniaceae) occur here. The recorded flora comprises 253 species, Cyperaceae numbering 33, Gramineae 20, and Melastomaceae 20. Fourteen species are first records for Jamaica, at least two being new species. Floristically, the savanna resembles upland savannas in tropical South America with parallels at family and genus level though the species mostly differ.

SKINNER, F. L. Dropmore, Manitoba. *Tree Breeding at Dropmore.* A review will be given of the work done at Dropmore in the breeding of fast growing, disease and insect resistant varieties of hybrid poplars and basswoods.

SKOK, JOHN. Argonne National Laboratory. *Relationship of Boron Nutrition to X-Irradiation Induced Genetic Effects in Sunflower.* An interaction between boron nutrition and radiation responses has been previously demonstrated by the author. Withholding boron from sunflower seedlings for short intervals prior to X-irradiation with doses that normally produce pronounced radiation symptoms had a marked alleviating effect on the development of radiation injury. Futher experiments showed that temporary withholding of boron prior to X-irradiation will also reduce certain X-ray induced genetic effects (leaf abnormalities in the following generation). Three distinct types of leaf abnormalities appeared in the offspring of irradiated control plants but were absent in the offspring of irradiated plants temporarily deprived of boron prior to irradiation. (This work performed under the auspices of the U.S. Atomic Energy Commission.)

SLANKIS, V. Canada Department of Agriculture. *On the Factors Determining the Establishment of Ectotrophic Mycorrhiza of Forest Trees.* According to the "carbohydrate theory" (E. Bjorkman, Symb. Bot. Ups. 6: 1–190, 1942) the lower symbiont enters the roots only when the root cells contain a surplus of soluble carbohydrates. At low light intensities such a surplus of sugars is lacking and as a consequence mycorrhiza are not formed. Roots, as a rule, undergo characteristic morphogenesis during their transformation into mycorrhiza. Such morphogenetic deviations reflect a profound metabolic change as well. These events seem to be the prerequisite for the establishment of symbiosis. Recent investigations have provided evidence to the effect that such morphogenetic deviations are caused by fungus-produced substances related to auxins. Using synthetic auxins such as indole-3-acetic acid, it has been possible to reproduce forms resembling mycorrhiza in pine roots *in vitro*. Roots, however, do not undergo this typical transformation at low light intensities, even when auxin is added at relatively high concentrations, despite the fact that soluble sugars were added to the nutrient. This indicates that besides the availability of a surplus of sugars the interplay of some other root metabolite(s) is equally important for the establishment of a symbiotic relationship.

Slankis, V. *See* Subba-Rao, N. S.

Slavik, Bohdan. Czechoslovakian Academy of Science. *Water Relations within the Area of One Leaf Blade.* Within one leaf blade there exist considerable differences in water relations. Marked longitudinal and transverse gradients of the osmotic pressure of cell sap as well as of water deficit were ascertained within the leaf blade of sugar beet and tobacco. As to the osmotic pressure of cell sap, the gradients from the base of the blade to the tip ranged in sugar beet around 40 per cent. These gradients were not noticeably changed in their distribution even when the leaves *in toto* were artificially saturated with water or when water deficit occurred or was adjusted by actual changes in the water balance. In these experiments the polarity of the transpiration stream was maintained. This stability found in various degrees of hydration (expressed in osmotic pressure of cell sap) in individual parts of the adult leaf blade indicates that the gradients mentioned are a result of the previous ontogenetic development of the leaf as a polar organ. As to the actual water deficit, similar heterogeneity within one leaf blade can be found owing to the different transpiration intensities in its parts. The heterogeneity found in the leaf with regard to the values here dealt with is an expression of the general physiological heterogeneity of the leaf blade.

Smetannikova, A. I. Academy of Sciences, Leningrad. *A Comparative Ecologico-physiological Investigation of Medick under the Conditions of the Northwest of the U.S.S.R.* The species studied were *Medicago sativa* L. from the North Caucasus; *M. tianschanica* Vass. (both the initial wild form and the strain cultivated at the Moscow Botanical Garden); *M. falcata* L. from Yakutia; variegated hybrid medick, variety (cultivar) "Severnaya 69" (the élite and the local reproductions of different years). The experiments have been carried out in the Karelian Isthmus (61° N) during the period 1947-58. The medick was studied in the cultures without cover crops, both pure and mixed. (1) Certain new data have been obtained on the physiological characteristics of the medick under the new adverse environmental conditions (photosynthesis, respiration, water metabolism, etc.). The difference between species and strains (most conspicuous in young plants and in those years when the meteorological conditions were unfavourable) have been established. Differences in certain physiological characteristics (the temperature of protein coagulation and some others) were observed to persist during several years. (2) The physiological characteristics in the medick are changed in the course of the growth and development of plants. The changes in the proportion of constituent herbs grass–legume in mixtures containing medick affect considerably the physiological processes in the latter. (4) The extension of the medick to the northern regions involves the abrupt increase in the content and the metabolic significance of the soluble carbohydrates and hemicellulose. (5) The cultivation of the medick (in particular, the species and varieties tested) in the Karelian Isthmus has proved to be promising not only for hay production, but for seed production as well. The advantages of the medick over red clover under these conditions also became apparent. (6) The complex physiological investigations of plants under new environmental conditions is of great importance for the construction of the theoretical basis for the understanding of the adaptation of plants and for the elaboration of new appropriate methods of cultivation.

SMETANNIKOVA, A. I. *See* KONOVALOV, I. N., *et al.*

SMITH, BEN W., and MARGARET C. GILES. North Carolina State College. *Karyotypic Asymmetry in a Dioecious, Annual Rumex.* Various annual or biennial species (composites and grasses) of disturbed habitats have evolved mechanisms which restrict genetic recombination. This tends to preserve the favored genotype and by enhancing fitness, promotes survival and increase in unstable environments. Three different methods are self-fertilization, apomixis, and chromosomal evolution which reduces recombination (Stebbins). Only the last of these is available to the dioecious annual which maintains its breeding system. *Rumex hastatulus* Baldw. is a dioecious annual, which grows in disturbed habitats. It has the lowest chromosome number known in its genus, $n = 4(5)$. Chiasma frequency is also low (at diakinesis). There are two chiasmata among the three sex-chromosomes (Y_1XY_2). The three autosome pairs have five to seven chiasmata: two or three in the longest chromosome, frequently only one in the shortest. The karyotype is asymmetric, type 1*b* of Stebbins' recent classification. The longest chromosome is three times as long as the shortest; all chromosomes have arm ratios between 1:1 and 2:1, except that the smallest chromosome is dimorphic. Among 108 plants, 76 were homozygous for median centromeres in this chromosome pair; eight plants were homozygous for sub-terminal centromeres. The remaining 24 plants were heterozygous. Both chromosome types are present in most of the North Carolina population; only four local samples among 17 appeared to be homozygous.

SMITH, C. EARLE, JR. Chicago Natural History Museum. *The Species of Cedrela (Meliaceae).* In the American tropics, wood of *Cedrela* (Spanish cedar or cedro) is locally an extremely important trade item. It is being successfully planted for reforestation both here and in the Old World tropics. First monographed by Casimir de Candolle in 1878, it has since been split into many species, varieties and forms which are much confused. From the examination of living trees in the field and in cultivation as well as much herbarium material including, at least, photographs of type collections for most names, I feel that the genus includes only seven species. There is not yet sufficient evidence that any of the minor variations warrant naming as varieties. Major changes include the merging of *C. mexicana* Roem, into *C. odorata* L., the restriction of *C. fissilis* Vell. to the pubescent-leaved *Cedrela* of southern South America, and the application of the name *C. angustifolia* Moc. & Sessé ex DC. to the puberulent Central and South Americas species which had formerly been lumped in *C. fissilis* or split into numerous species on minor variations. Much of the confusion in the genus is due to the weedy nature of cedro (it is usually present in second growth) and to its apparent close species relationship which allows interbreeding wherever two species grow in close proximity.

SMITH, DALE, M. University of Kentucky. *Variation in the Tetraploid Sunflowers, Helianthus decapetalus, H. hirsutus,* and *H. strumosus.* The perennial sunflowers *Helianthus decapetalus* L., *H. hirsutus* Raf., and *H. strumosus L.*, occur sympatrically as tetraploids ($n = 34$) in the central United States. Throughout this region these taxa are extremely difficult to separate by conventional taxonomic methods because of morphological similarity. Introgression is undoubtedly responsible for a great deal of this intergradation since hybrids have been discovered in nature and have been produced in the experimental garden. However, genetic variation from at least two other sources seems to exist, namely, segregation of variants from an unstable segmental allotetraploid complex, and the possible polyphyletic origin of *H. strumosus*. This information suggests that if the criterion of interspecific sterility were to be rigidly employed in the species concept, the taxa discussed here should be considered one species. However, this would tend to obscure differences in morphology, ecology, and phylesis for the sake of a single criterion. The traditional treatment of these taxa as separate species is being followed until a more flexible system of nomenclature is developed.

Smith, Frederick G., H. Melvin Couey, and Eugene L. Sharp. Iowa State College. *Cation Effects in the Germination and Germ-tube Development of Puccinia coronata Uredospores.* Differentiation of structures resembling those found in infected host plants occurred when uredospores of *Puccinia coronata* Corda var. *avenae* F. and L. were germinated on gelatin containing $10\text{-}20 \times 10^{-5}$ *M* Zn in the pH range 6.0-7.5. Other metal ions, including Cd, Cu, Fe, Mg, Ca, Mo, Co, and Mn, did not replace Zn; and agar did not replace gelatin. Studies with deionized gelatin prepared by ion exchange columns showed that Ca and Mg would antagonize Zn toxicity and restore the ability of Zn to induce germ-tube differentiation with the optimum pH shifted to about 8. Further evidence that suitable regulation of Zn activity would result in germ-tube differentiation was observed on amino acid solutions, apparently acting as Zn buffers. A significant interaction between H ions and Ca and Mg ions in the germination process also was established on purified substrates. Consideration of quantitative relationships suggests that uredospore germination and germ-tube differentiation are influenced by cation binding sites of the cell.

Smith, G. E. *See* Waygood, E. R.

Smith, James H. C. Carnegie Institution of Washington. *Protochlorophyll Holochrome: Its Spectroscopy and Photochemistry.* Protochlorophyll, precursor of chlorophyll in leaves, is phototransformed to chlorophyll when in its natural state but not when in organic solvents. A study of this transformation required that absorption spectra of protochlorophyll be measured both in organic solvents and in leaves and their aqueous extracts. Discrepancies in the absorption spectra of protochlorophylls from leaves and inner seed coats suggest that different protochlorophylls exist. Comparison of protochlorophyll spectra in organic solvents with those in leaves and in aqueous extracts of the holochrome, and with the action spectrum for the protochlorophyll-chlorophyll conversion indicates that the pigment involved is essentially the same in all cases. Native protochlorophyll absorbs at longer wavelengths than protochlorophyll in organic solvents. Two native protochlorophylls exist: one (λ_{max} 648 mμ) is much more reactive than the other (λ_{max} 635 mμ). Analytical and fluorescence-depolarization measurements indicate that each holochrome molecule probably contains only one protochlorophyll. Quantum-yield measurements, made in collaboration with Dr. C. S. French, show the conversion efficiency to be about 0.6 molecules per quantum. The chlorophyll initially formed (λ_{max} 684 mμ) quickly changes to another form (λ_{max} 670 mμ) through thermal processes. Possible mechanism will be discussed.

Smith, Lyman B. U.S. National Museum. *Floral Relationships of Southern Brazil.* The flora of southern Brazil appears to be almost entirely an immigrant one derived from centers of development on all sides. Its greatest source is from central Brazil, whence most of its genera have spread with considerable diminution in species as they adjust to cooler climates. The genus *Psychotria*, for instance, drops from about two hundred species in central Brazil to fifteen in Santa Catarina and five in Rio Grande do Sul. There are continuous linkages with the Amazon, the Andes, and Argentina, and there are disjunct ones with the Amazon, North America, the Andes, and even Africa *(Xyris capensis)*. Except for the coastal flora the most important influence is climate and this is particularly well shown in the interplay of continuous and disjunct ranges in the genera with Andean affinities. *Araucaria* with one species in southern Brazil and another in the southern Andes indicates a long-standing barrier, while other genera such as *Berberis* and *Hypericum* show that the barrier is not complete. These Andean genera are characteristic of cool, moist climates and their eastern and western components are becoming separated by the invasion of a warmer climate from the north and a drier one from the south.

SMITH, LYMAN B. U.S. National Museum. *Floras of South America, Past, Present, and Future.* A survey of the floras of South America shows what we can expect in the future and how we can best achieve it. The primary objective is to facilitate identification; so the ideal flora contains descriptions, keys, citations or ranges, and illustrations of all the species, and is published all at once. This seldom has been achieved on a large scale and never in South America. It requires strong financial backing and a number of competent writers. As a result South American floras must balance desiderata. *Flora Brasiliensis*, the best known and largest flora, fulfils most requirements, but took 66 years to complete. *Flora Brasilica*, essentially its second edition, bids fair to take as long. Lists are very helpful in the absence of detailed floras. Notable are those of Pulle for Surinam, Pittier for Venezuela, Philippi for Chile, Hassler for Paraguay, and Herter for Uruguay. Partially complete but highly useful floras include one on Chile by Reiche, one on Peru by Macbride, and one on Surinam by Pulle. Floras of natural areas are the completed Princeton report on Patagonia and Maguire's just commenced study on Guayana Highland. Cabrera's flora of Buenos Aires is an outstanding local flora and Reitz's flora of Santa Catarina, Brazil, should be equally useful.

SMITH-WHITE, SPENCER. University of Sydney. *Structural Hybridity and Pollen Tetrad Segregation in Astroloma. A. conostephioides* is a perennial heath shrub belonging to the tribe Styphelieae of the Epacredaceae. Its pollen is matured in segregating tetrads, that is, in tetrads in which some microspores abort. The majority of wild plants are heterozygous for one or two chromosomal inversions, and it seems probable that only a limited number, perhaps very few, inversions are present in any population. In meiosis, chiasmata are localized to a substantial degree and there is extreme regularity in chromatid bridge formation. Inversions can be identified as proximal, yielding nearly 100 per cent of first division bridges, or as distal to a single chiasma, yielding bridges in all mother cells, these being second division bridges in up to 50 per cent of cells. The relationship between structural hybridity and pollen tetrad segregation will be examined.

SMITINAND, TEM, and MARCEL RAYMOND. Royal Forest Department, Bangkok, and Montreal Botanical Garden. *The Need for Modern Floras of Thailand and*

Indo-China. The need of a modern flora for Thailand is obvious since at the moment there is no flora at all. A local flora of Koh Chang appeared at the beginning of the century, the work of Danish botanists; and the publication of an enumeration of the Thai vascular plants was begun in 1925, to which Kerr, Craib, Fletcher, Pendleton have devoted considerable energy, but which is still unfinished. French botanists published, between 1907 and 1951, a *Flore générale de l'Indo-Chine,* under the direction of Lecomte, in which Thailand specimens are sometimes considered, sometimes not. Lecomte's flora covers several thousand pages; unfortunately, the treatment of some families leaves much to de desired and there has been no supplement since 1950. In some cases whole families have to be rewritten, so numerous have been the collections made since the publication of the various fascicles, not mentioning the nomenclatorial changes. For example, the genus *Carex* was represented by 25 species in 1911, whereas 83 are known now. Since the flora of the whole peninsula is a very rich one, with the descriptions of numerous species scattered in various publications, the proper procedure would be to write first a concise flora of Thailand, and another one for Indo-China, that could be used in the field and stimulate collectors. When more is known about the distribution of each species, a more elaborate critical flora could be contemplated.

SNYDER, WILLIAM C. University of California. *Heterokaryosis as a Natural Phenomenon.* Heterokaryosis is an almost universal phenomenon in fungi in nature. Whether one thinks of heterokaryosis in terms of the single cell or of a single thallus composed of many cells, heterokaryosis is the association therein of genetically different nuclei. Such nuclear associations may arise through mutation but are more common than mutations in fungi since the association of different nuclei may arise through other ways, such as by anastomosis. In higher fungi a condition of heterokaryosis may become obligate, such as in the dikaryon of the rusts, and is a forerunner of sexual fusion. Heterothallism itself has its basis in heterokaryosis which precedes and follows meiosis. In the imperfect fungi where heterokaryosis again is commonplace, no direct relation to sexuality may be evident. But whether heterokaryosis appears to be directly linked with sexuality or not, the phenomenon permits an increased capacity in the organism to adapt itself to changes in environment. Heterokaryosis is expressed sometimes as a rhythmic phenomenon which provides the fungus with an unusual flexibility for survival in nature.

SOLYMOSY, F. *See* FARKAS, G. L., *et al.*

SOPER, JAMES H., and JOHN M. POWELL. University of Toronto and McGill University, Montreal. *Botanical Studies in the Vicinity of Lake Hazen, Northern Ellesmere Island.* Field studies were carried out by the authors working from the Canadian I.G.Y. base at Lake Hazen in an area between 81° and 82° north latitude on northern Ellesmere Island, N.W.T., Canada. Lake Hazen lies in a trough with rolling plateaus to the east and a series of mountain ranges merging into a large ice-cap to the west. The climate is severe with low mean temperatures and an extremely low precipitation but the frost-free period is about seventy days, favoured by continuous daylight. The phenomena of soil movement such as solifluction and congeliturbation have been important in preventing the establishment of a stable vegetation. However, there were two main types of vegetation observed which formed a continuous cover over limited areas—a hummocky tundra and a wet meadow. A large proportion of the land surface had open associations of various sorts, depending on the soils, exposure, and drainage. These areas have been classified into those widespread plant habitats such as clay barrens, scree slopes, nunataks, rocky terraces, deltas, gravel ridges, lakes and ponds, and the more specialized eutrophic types. Collections of vascular plants were made representing over one hundred species and indicating a comparatively rich flora for this latitude. A third of these also occurred at altitudes above three thousand feet on the nunataks. A number of range extensions and several new records for Ellesmere have resulted.

Sorokin, Constantine. University of Maryland. *Temperature Studies on the Cellular Level.* Temperature dependence of respiration and photosynthesis and temperature and illuminance dependence of growth were studied in the low- and high-temperature strains of the green unicellular alga, *Chlorella pyrenoidosa.* It was observed that values of activation energy for growth reflect not only the temperature and illuminance dependence of the accumulation of cell material but also that of cell division. In any temperature range the values of activation energy are characteristic of neither of these two processes but are influenced by both of them. In studies on steady-state microbial populations the situation is complicated by the fact that such populations consist of cells of different developmental stages with different metabolic activity and different prevalence of the processes of the accumulation of cell material and of cell division. The statistical averages obtained for cellular characteristics of steady-state populations may or may not be intrinsic to any portion or even to a single cell of the population. Values of activation energy for respiration and photosynthesis as dependent of the relative preponderance of the processes of the accumulation of cell material and cell division are not more reliable for the characteristic of a single process or reaction than those for growth.

Sorokin, Helen P. Winchester, Mass. *Studies on Living Cells of Seedlings: The Occurrence of a Plasmodiophoraceous Parasite.* The stems of 7-day-old etiolated pea seedlings grown in water from seed obtained from different localities in 1958 were infected with an intracellular plasmodiophoraceous parasite. Moderate infection produces little detectable change in stem elongation and thickening, but badly infected stems develop less growth, often become swollen and twisted, and it is probable that they elongate less when cut than do normal controls. Starch accumulates in the parenchyma cells of the third internode and the redox-indicator dyes show high reducing activity. There appear to be two types of plasmodia. One, considered as "primary," forms flat sheets or bands which are easily folded and which may envelop the host nucleus. This plasmodium forms gourd-shaped sporangia with a thick membrane and long escape tubes. Spore precursors are born on the inner side of the sporangium adjacent to the central vacuole. Reduced dye is usually shown in the vacuole and the spores. The "secondary" plasmodium is granular, lacks the membrane, and shows typical cross-shaped figures of protomitosis characteristic for *Plasmodiophorales.* The organism resembles *Polymyxa graminis* Ledingham, but differs in the habitat and resting spore formation. Nematodes are present in infected tissues.

Sotchava, Victor. Académie des Sciences, Leningrad. *Résumé de l'étude botanico-géographique de la taiga sibérienne.* Au cours de ces dernières années les progrès de la cartographie géobotanique ont contribué aux progrès de l'étude de la taiga sibérienne, divisée, dans les plaines et sur les plateaux, en taiga septentrionale, moyenne et méridionale. C'est la taiga moyenne qui occupe la plus grande surface; sa limite au nord coincide avec la dernière limite, au sud de la pénétration de l'air arctique dans les régions du continent. La taiga va le plus loin au sud dans la région des moussons de l'Asie Orientale (dans les montagnes jusqu'à 37° de latitude nord). Dans l'Asie septentrionale, la végétation de la taiga présente quatre séries zonales (la série de la Sibérie occidentale, celles de la Sibérie centrale, de la Sibérie occidentale, et celle de l'extrême-Orient). Les forêts de *Picea* (*obovata, ajanensis*), *Abies* (*sibirica, nephrolepis*), *Pinus* (*sibirica, pumila*) qui recouvrent 72% de la surface, se trouvent surtout dans les montagnes où le climat, moins continental, favorise leur croissance. Le *Pinetum pumilae* est très fréquent dans les montagnes (près de 340 km^2.) où la mousson du Pacifique se manifeste à une altitude très élevée. La circulation des masses d'air influence beaucoup des particularités régionales de la taiga. Le *Laricetum* domine surtout dans parties les plus continentales de la Sibérie. Le *Picea* y est favorisé par la grande teneur en carbonate des roches. Quelques associations de *Laricetum dahuricae,* se trouvant dans les mêmes conditions, possèdent des éléments floristiques steppiques et arcto-alpins en plus de leur élément de flore boréale. On distingue six types de zonalité verticale dans la végétation de la taiga (types Altai-Saian-occidental, Saian-oriental des environs du Baikal, sibérien central, sibérien-oriental, Amour-Sakhaline, Kamtchatka). Plusieurs particularités de la taiga des montagnes ont pour cause les mouvements tectoniques les plus récents. La taiga a commencé à se former pendant le néogene par la transformation des forêts mixtes arcto-tertiaires. Les forêts de haute montagne du sud, des étages moyen et subtropical (*Picea* (*Schrenkiana, likiangensis, spectabilis,* etc.), *Abies* (*squamosa, Delavayi, spectabilis,* etc.)) ne se rapportent pas au type de végétation de la taiga.

SOTO, C. *See* GARCIA, ENRIQUETA, *et al.*

SPARROW, ARNOLD H., and LLOYD A. SCHAIRER. Brookhaven National Laboratory, Upton, N.Y. *The Role of Certain Chemical and Physical Factors in Tumor Formation in Several Plant Genera.* It is well known that many kinds of abnormal plant growths are highly specific as to host and inducing agent, whereas others are relatively non-specific. Tumorous growths or proliferations of the latter type have been induced by ionizing radiation in the amphidiploid *Nicotiana glauca* × *langsdorffii.* Less extensive data from irradiated *Saintpaulia, Kalanchoë, Graptopetalum paraguayense,* and *Cicurbita pepo ovifera* suggest a more specific response. Our most extensive work has been done with the *Nicotiana* tumors for which the responses to various doses of X, beta, gamma, and neutron radiation have been obtained. Tumors have also been induced in the *Nicotiana* hybrid by treatment with appropriate concentrations of triiodobenzoic acid (TIBA) and of maleic hydrazide. In combination with radiation, TIBA appears to have a synergistic effect. Preliminary tests also show that tumor formation is greatly enhanced by the exclusion of visible light from the top half of young plants. Data pertaining to the above experiments will be presented and discussed with reference to possible mechanisms of tumor initiation.

SPARROW, ARNOLD H., RHODA C. SPARROW, and VIRGINIA POND. Brookhaven National Laboratory, New York. *Sterile Culture of Excised Anthers of Trillium* *erectum.* Several years have been spent in developing a technique which permits the growth of excised anthers of *Trillium erectum* in sterile nutrients. The main criterion for evaluating the media tested was the apparent normal development of these synchronous pollen mother cells from pachytene of meiotic prophase through the first microspore mitosis. Of the nine media tested, the most successful was modified Bonner's medium plus coconut milk. Anthers transferred as early as leptotene showed normal development. None was tried at earlier stages. The time span for development from early meiotic prophase to microspore mitosis is 10-14 weeks at 4-6° C. A comparison of spontaneous and induced frequency of chromosome fragmentation was made in cells from *in situ* and *in vitro* anthers. The results indicate that chromosome physiology and behavior, as reflected by degree of fragmentation, have not been appreciably altered in cultured anthers. Further, a preliminary comparison of the time span to microspore division in cultured and *in situ* anthers shows little if any difference. There are many potential uses and advantages to culturing excised anthers. These include applications in cytological, genetic, and physiological experiments, and perhaps even in practical plant breeding. However, much additional testing of new media and methods seems highly desirable before general applications will be feasible.

SPARROW, RHODA C. *See* SPARROW, ARNOLD H., *et al.*

SPEAR, IRWIN. University of Texas. *Products of $C^{14}O_2$ Fixation as a Function of Photoperiod.* Short- and long-day treated plants of *Kalanchoë blossfeldiana* were permitted to fix $C^{14}O_2$ at intervals during the light and dark phase. Although there were no significant qualitative differences in the products of fixation, important quantitative differences were observed. *Xanthium* plants were permitted to photosynthesize $C^{14}O_2$ at the end of a long light phase and the plants were then permitted to convert the light fixation products during the short, long, and interrupted dark periods. The leaf blades, petioles, and buds were extracted separately and the radioactive compounds present in each under the different dark treatments will be reported.

SPIKES, JOHN D. *See* MAYNE, BERGER C., *et al.*

SPRAGUE, RODERICK. Washington State College. *Epidemiology and Control of Snow Mold of Winter Wheat and Grasses in the Pacific Northwest of the United States. Fusarium nivale, Typhula idahoensis,* and *T. itoana* cause most of the snow mold of winter cereals and grasses in the Pacific Northwest. The *Fusarium* thrives in the cold interior and also on the humid coast where it is serious in turf. *Typhula* is important as a winter scald of wheat. When snow falls on unfrozen ground and stays until spring, losses are severe. Decay may start in December but is most active from February to April. Late summer seeding of winter wheat is important. No varietal resistance is known. Where adaptable, legumes in rotation help reduce *Typhula,* while spring-seeded wheat escapes. Fertilizers are of no value. Ceresan M2X (ethyl mercury p toluene sulfonanilide 15.4 per cent), 2.5 lb. in 20 to 30 lb. of heavy talc per acre gives good control when applied in late October but costs about $6 to $7 per acre. Ceresan 200 (ethyl mercury acetate 1.3 per cent; ethyl mercury 2,3-dihydroxyl propyl mercaptide 6 per cent) and Mema (methoxy ethyl mercury acetate 11.4 per cent), both liquids, are also effective and costly. Many other materials have failed. A life history diagram of the development of *Typhula* displays that mycelium on decaying host parts in the soil is important in spreading infection.

SPURR, ARTHUR R. University of California. *Effects of Phenylboric Acid on Cell-wall Structure and Cell Growth in Phaseolus.* Seedlings of bean (*Phaseolus vulgaris* L.) treated with phenylboric acid applied in lanolin to the epicotyl show profound effects on cell walls and cell growth as observed by light microscopy. Cortical cells in stems of control plants have thin walls ($\pm$ 0.92μ). Treatment with phenylboric acid induces thickening ($\pm$ 5.7μ) of the walls. The intercellular spaces in normal plants are essentially triangular in cross-section. In treated plants the spaces are round or oval indicating that the wall material is more plastic in quality. The structural features of the walls (intercellular substance and cellulose lamellae) in normal stems are more clearly defined than in treated plants. This suggests that the components in treated plants are more easily displaced during growth and gives further evidence that the wall material is more plastic than in normal plants. Phenylboric acid inhibits growth in length of the shoot apparently through premature expansion and maturation of the cells. Mean cell diameter in the cortex of normal stems is 57.8μ, whereas in treated plants it is 122.5μ. These effects on the shoot of bean point toward phenylboric acid as a growth regulator in cell development. It is possible that as phenylboric acid stimulates growth, boron is released. Changes observed in cell-wall structure may be due in part to a toxic effect of the released boron.

SQUILLACE, A. E., and KEITH W. DORMAN. U.S. Department of Agriculture. *Selective Breeding of Slash Pine for High Oleoresin Yield and Other Characters.* Selection and breeding of slash pines (*Pinus elliottii* Engelm.) for high-oleoresin yield began at the Lake City, Florida, Research Center in 1941. Progenies produced from both controlled and wind pollinations are now 13 years old and have been tested for gum-yielding capacity. Inheritance of this trait was demonstrated and heritability estimates computed. This information, along with a separate study of the natural phenotypic variation of this trait, provided a basis for estimating the theoretical degree of improvement possible through (1) continuous selection and breeding and (2) progressive establishment of seed production areas. Advantages and disadvantages of both of these methods are pointed out. Seed orchards using vegetative propagules of selected first-generation progenies of proven parents are also being established. The same breeding work permitted less intensive studies of inheritance of other characteristics, and the results of these are briefly discussed. Among these, the variation and inheritance of gum viscosity, gum exudation pressure, tracheid length, and stem deformities were demonstrated.

SQUILLACE, A. E. *See* BINGHAM, R. T., *et al.*

SRB, ADRIAN M. *See* MUNETA, JOAN; MURRAY, JAY C.

STADELMANN, EDWARD J. University of Freiburg. *The Use of Mercié's Method of Freeze Drying for the Preparation of Fungi for Demonstration.* For permanent preservation of shape, structure, and color of fruiting bodies of fungi, Mercié (Bull. Soc. Bot. France, 1945 ff.) introduced the method of freeze drying the intact fruiting body. The treatment of the presented preserved specimen began with a rapid cooling to –22° C. after one-day water imbibition. Subsequently the drying was executed at a temperature of –10° C., and a vacuum of about 5.10^{-2} mm. Hg for about three weeks. Sometimes a slight shrinking is to be observed at the end of this treatment, but since it is uniformly distributed it does not alter the appearance of the specimen. Colors are preserved completely unchanged. The completely dry fruiting body is brittle and hygroscopic. To prevent a re-uptake of water, which causes distortion of the shape and change of the appearance, the specimen has to be protected by keeping the dry fungus in a museum jar (Mercié) or by covering its surface carefully with Japan varnish to seal it completely. The last method was used for the preparation of the presented specimen and has the advantage of greater ease of handling.

Stange, Luise. Universität zu Köln, Germany. *About Correlations between Differently Regenerating Cells in Riella.* After isolation from the apical meristem the differentiated cells of *Riella* acquire properties of meristematic cells. In this process of regeneration the cells can take three different directions. (1) After an initial phase of increase in the size of the nucleolus, which is the same for all regenerating cells, some cells enter nucleus and cell division to form cauloids. (2) In some other cells the nucleolus increases further in size and the cells grow out without division to form rhizoids. (3) In most cells the size of the nucleolus decreases again. The directions of differentiation 2 and 3 are dependent on the presence of dividing cells. The differentiation of rhizoids can be interrupted by interrupting the connection to dividing cells. On the other hand, the continuation of cell divisions is dependent on the presence of rhizoids. 3-indolylacetic acid (IAA) influences the correlations between dividing and rhizoid-forming cells by increasing the number of rhizoid-forming cells. IAA has not the same effect after induction of regeneration by plasmolysis leading to isolation of single cells. Different exposure times to light greatly influence the number of regenerating cells in a tissue fragment. Conceptions about the nature of the correlations will be mentioned.

Stanley, Robert G. U.S. Forest Service. *Metabolic Studies of Pine Pollen and Their Potential Application in Tree Breeding.* In many crosses fertilization fails to take place, or the embryo aborts before maturing. Efforts to understand the biochemical processes of pollen growth and how they may be manipulated to facilitate or accelerate hybridization are the subject of these studies. By means of radioactive sugars, the various pathways by which carbohydrates are metabolized are being followed. The capacity of pollen to utilize glucose under varying oxygen levels, as may exist in the closed cone, has been investigated. Changes in the enzymic pathway of glucose oxidation in germinating pollen have been plotted. The mechanism of pollen-tube growth stimulation by boron, an interaction with carbohydrate metabolism, has been studied with radioactive glucose. In addition, pine pollen has been shown to incorporate $C^{14}O_2$ along many of the pathways formerly recognized as occurring only in tissues containing chlorophyll. The CO_2 is rapidly incorporated into amino acids and proteins. Subcellular units of pollen cytoplasm are being isolated and their individual contributions to the genetic potential of the progeny are being investigated. Field techniques which would permit pretreatment of pollen so as to produce an accelerated metabolic pattern, or a modification of the pollen enzyme constitution, thus facilitating fertilization or embryo development, are being sought.

Starr, Mortimer P. University of California. *Pectin and Galacturonate Metabolism of Phytopathogenic Bacteria.* Certain phytopathogenic bacteria damage plants by virtue of an ability to decompose the pectic substances of the plant cell wall. Soft rot is the most obvious, but by no means the sole, clinical symptom following infection by pectinolytic bacterial phytopathogens. The tissue maceration which follows pectic decomposition probably reflects only a part of the phytopathogenic capabilities of these bacteria. Little is known about the breakdown of the pectic materials as they occur in the plant, largely because of ignorance of the chemical nature of the native pectic substances ("protopectins"). A substantial, albeit contradictory, literature exists on the "protopectinases," pectin esterases, polygalacturonases, and "depolymerases" of phytopathogenic bacteria, and on the pathological consequences of the activity of these enzymes. In recent years, it has been possible to unravel the pathway of catabolism of the pectin monomer, D-galacturonic acid. In *Erwinia carotovora*, the first steps are isomerization to the keturonic analogue (5-keto-L-galactonic acid) and reduction to D-altronic acid; this is followed by dehydration, phosphorylation, and a split to pyruvate and triose phosphate. In *Pseudomonas syringae*, an entirely different scheme is unfolding which begins with an oxidation of galacturonic acid to mucic acid.

Staudt, G. Max-Planck-Institut für Züchtungsforschung. *Cytotaxonomy and Phylogenetic Relationships in the Genus Fragaria.* It has been proved that chromosome numbers are an important factor in taxonomy of Fragaria. At present 8 diploid species are known. Most of these are different in their morphological characters as well as in their geographical distribution with the exception of *Fragaria viridis* and *nubicola*, which are probably closely related. They can only be crossed with great difficulty and the hybrids are of very reduced fertility. Chromosome pairing in meiosis, however, is nearly normal. Genomes, therefore, may be on the whole homologous and decreased fertility the result of cryptic structural differences and/or plasmatic differences. The *vesca*-complex is distributed in Eurasia and North America. The eastern American ssp. *americana* is more similar to the Eurasiatic ssp. *vesca* than both to the western American ssp. *californica, bracteata* a.o. Middle and East Asia may be a center of diversity and also a center of origin for many polyploid species, especially the tetraploids. The recently discovered *Fr. mandschurica* from Manchuria probably is an ascendant of the tetraploid *Fr. orientalis*. Tetraploids can readily be crossed with another. The progenies are fully fertile. The only hexaploid, *Fr. moschata,* is distributed in Europe. It may have originated in Europe or Asia by crossing *Fr. vesca* × *nubicola* or *viridis,* both of which have corresponding characters with *Fr. moschata.* Octoploids hitherto have been known only from America. They cannot be derived from the diploid species growing there too. They must have immigrated from East Asia, where we find corresponding characters in some species like *Fr. iinumae* (Japan) and *daltoniana* (Himalayas). All octoploid species can be hybridized without difficulty. Geographical distribution and morphological characters cause us to suspect that octoploids have arisen polyphyletically.

Stauffer, J. F. University of Wisconsin. *Induced Mutation in Penicillin* in a single stock of *Penicillium chrysogenum* were carried out in the Antibiotics *Biosynthesis.* For over ten years, studies on spontaneous and induced variation Laboratory of the Botany Department at the University of Wisconsin. The ancestral wild form was NRRL 1951, isolated in Illinois in 1943; the entity on which the Wisconsin studies began was strain X-1612, an improved derivative of NRRL 1951 which yielded approximately four times as much penicillin. Further substantial increases in the synthetic capacity of the fungus were incorporated into this stock in a number of unequal steps, over a long series of generations, as the "Wisconsin Family" of strains of *P. chrysogenum* emerged. Ultraviolet radiation and nitrogen mustard, methyl-bis (β-chloroethyl) amine, were both successfully employed as mutagenic agents. In the irradiation work, a wavelength of 2,750 Å was used primarily, and improvements in the stock were secured with very low, medium, and high dosages. Selection of favorable spontaneous variants also contributed to the quality of the fungal line at various points. For the fermentation conditions employed, there was built into the *P. chrysogenum* stock in question, during the course of the work at Wisconsin, approximately a tenfold increase in ability to produce the antibiotic. Complete elimination of yellow pigment was accomplished in a single step.

Stearns, Forest. U.S. Forest Service. *Soil Temperature and Moisture Patterns and Phenology in a Loess Area.* Soil temperature, soil moisture, and phenology were studied in a meadow and a hardwood forest near Vicksburg, Mississippi. These studies, carried out as part of the development of a system for the estimation of soil moisture, helped demonstrate the need to differentiate seasons which apply specifically to soil moisture loss. When each year was divided into four seasons, each season was found to have a characteristic moisture depletion curve. These seasons were not directly coincident with growing seasons and varied with the vegetation. In the forest, the moisture loss curve for the upper foot of soil became steeper about the time that trees reached 60 to 80 per cent of full leaf and steepened again several weeks after leaves were fully expanded. The rate of moisture loss dropped shortly after leaves began to show autumn color and dropped again several weeks after leaf fall was complete. In the spring increases in moisture loss occurred earlier in the meadow area, while in the fall diminution in rate usually occurred earlier in the forest. Soil temperature and phenologic regimes were somewhat similar for the five years of study, while the soil moisture regime was more irregular. Variation is discussed in relation to major deviations from normal air temperature and precipitation. The soil moisture estimation system was used to fill gaps in the record.

Stebbins, G. L., and B. Crampton. University of California. *A Suggested Classification of Grass Genera of North America Based on Modern Criteria.* In the light of investigations carried on during the past thirty years by Avdulov, Prat, Hubbard, Reeder, Brown, Stebbins, and others, a revision of our concepts on grass phylogeny is necessary. This revision must be based on many characteristics in addition to spikelet morphology. Many resemblances in characteristics of spikelet morphology are due to parallel or convergent evolution and hence are poor indicators of true phylogenetic relations. Representative North American genera of grasses have been examined from the standpoint of seedling form, leaf anatomy and histology, lodicule and caryopsis form, embryo structure and chromosomal characteristics. Of the 185 genera enumerated by Hitchcock and Chase as occurring in the United States, 126 have been retained in the same tribes, while 59 have been reclassified. The greatest amount of revision is in the tribe Festuceae from which 25 of its 41 genera have been removed, while three have been added. Eleven out of the 26 genera have been removed from the Agrostideae. The tribe Zoysiaeae is merged with the Chlorideae and the Tripsaceae with the Andropogoneae while the following additional tribes are recognized: Ehrharteae, Orcuttieae, Unioleae, Arundineae, Danthonieae, Stipeae, Spartineae, Meliceae, Pappophoreae, Eragrostideae, Sporoboleae, and Aristideae.

STEBBINS, G. LEDYARD. University of California. *Biosystematics and Evolution: A Recapitulation of Our Present Position.* The modern approach to problems of taxonomy in relation to evolution is based largely upon the development of the chromosomal theory of heredity in its broadest sense, and the application of principles developed from this theory through quantitative observations and descriptions supplemented by experiments under conditions which combine a certain degree of control of environmental factors with an approach as nearly as possible to environmental conditions. The basic axiom for all workers in this field is that knowledge about evolutionary relationships can be obtained only by a synthesis of evidence from every possible field of endeavor, and that over-emphasis of evidence from any particular field will almost certainly lead to erroneous conclusions. The data and conclusions reported by the previous speakers are examined in the light of these postulates.

STEBBINS, G. LEDYARD. *See* JAIN, SUBODH K.; KHUSH, G. S.; SHAH, SURYAKANT S.

STEEL, ROBERT. The Upjohn Company, Michigan. *Some Effects of Agitation on Antibiotic Production in Submerged Fermentation.* A study was made of the effects of different amounts of turbulent shear and flow, produced by mixing impellers, on antibiotic production by an organism resembling *Streptomyces achromogenes.* Turbulent shear (αN^2D^2, where $N =$ impeller speed and $D =$ impeller diameter) and flow ($\mu \mathrm{ND}^3$) were related to impeller diameter and speed as given by Rushton and Oldshue. The turbine impellers used were geometrically similar and ranged from three-tenths to five-tenths of the fermentor diameter. The oxygen solution rate during the period of maximum oxygen uptake was maintained constant in all cases by suitable adjustment of the air flow rate. With the different sizes of impellers studied, variations in relative turbulence (from 1.0 to 0.5) and flow (from 1.0 to 2.0) did not appear to influence antibiotic production. Rushton's power correlation was found satisfactory for prediction of the relation between impeller diameter and speed for constant oxygen solution rate. The influence on antibiotic production of further values of relative shear (from 1 to 5.8) and flow (from 1 to 2.4) was studied by increasing the impeller speed from 300 to 800 r.p.m. using a turbine impeller four-tenths of the tank diameter. Under these conditions the antibiotic titre was decreased about 25 per cent at the highest stirring speeds tested. Other differences were also noted between fermentations operated at low and high agitator speeds.

STEEMANN-NIELSEN, E. Danmarks Farmaceutiske Hojskole, Copenhagen. *Light Adaptation in Marine Phytoplankton.* A series of light intensity photosynthesis curves of marine phytoplankton is presented including curves of plankton from both the surface and the lower part of the photosynthetic layer, curves of arctic, temperate and tropical plankton, and curves of both summer and winter plankton. Only if the water masses within the photosynthetic layer are vertically stabilized, thus preventing vertical mixing, does a differentiation in "sun" plankton and "shade" plankton take place. In the former the rate of light-saturated photosynthesis computed per unit of chlorophyll is high. The compensation point is found at 600 to 1,200 lux. In "shade" plankton the rate of light saturated photosynthesis per unit of chlorophyll is low; the compensation point is found at 200 to 450 lux. Winter plankton from the surface in temperate regions behaves photosynthetically like shade plankton. According to all evidence the light adaptation is brought about simply by establishing a higher or lower concentration of the enzymes active in photosynthesis. The rate of light-saturated photosynthesis is a combined result of enzyme concentration and temperature. In arctic waters the concentration of enzymes is high compared with that at lower latitudes, both in relation to concentration of chlorophyll and in relation to the content of organic matter in the algae.

STEEVES, TAYLOR A. University of Saskatchewan. *The Development of Leaves in Sterile Nutrient Culture.* In a variety of ferns and in two species of flowering plants, leaves excised at the primordial stage will complete their development to maturity on a nutrient medium of relatively simple composition. Since, in all cases, a small but characteristic leaf is produced, it may be concluded that the factors which control the fundamental aspects of leaf morphogenesis are contained within the organ itself once the primordium has been determined at the shoot apex. This interpretation has been extended somewhat by studies of the ten youngest primordia in the apical bud of *Osmunda cinnamomea*, a fern characterized by a slow rate of leaf development. Frequently such primordia, particularly the youngest five, give rise to a shoot; and even where a single leaf is formed, this regularly produces a root near its basal end. Thus a leaf primordium, if removed from the influences to which it is normally subjected in the region of the shoot apex, prior to its final determination, will revert to an expression characteristic of the shoot apical meristem. The significance of these observations in the general framework of leaf morphogenesis and the possibilities which the sterile culture method provide for an experimental analysis of leaf determination will be discussed.

STEFFENSEN, D. M. *See* STEIN, OTTO L.

STEGWEE, DURK. Agricultural University, Wageningen, Netherlands. *Multiplication of Plant Viruses in Their Aphid-vectors.* Until recently the evidence for the multiplication of plant viruses in their insect-vectors was restricted to only five viruses, all of which are transmitted by leafhoppers. Indications for the occurrence of multiplication of potato leaf-roll virus in its vector, the aphid *Myzus persicae* (Sulz), were obtained by Day (1955), but on the other hand Harrison (1958) was led to conclude from his own experiments that no such multiplication took place. On theoretical grounds, Limasset (1956) even thought it highly doubtful whether this phenomenon could exist in aphids. Stegwee and Ponsen (1958), however, were able to carry potato leaf-roll virus from insect to insect in a series of fifteen passages without access of inoculated insects to any plants susceptible to the virus. The theoretical dilution of the virus at the end of the experiment as compared with the dilution end-point indicated that the virus had multiplied within the aphid. The implications of these findings with respect to the results of earlier experiments will be discussed.

STEHLÉ, HENRI. Centre de Recherche des Antilles, Pt. Bourg, Guadeloupe. *Les Végétaux de la flore spontanée aux Antilles françaises susceptibles d'utilisation horticole.* L'utilisation des végétaux spontanés de la flore antillaise peut être considérée à un double point de vue horticole: ornemental ou d'arboriculture fruitière. Parmi les ornementeuse figurent les fougères arborescentes, les palmiers, les arbres et arbustes, les grandes Graminées et Cypéracées, des suffrutescentes et grandes herbes, des plantes herbacées, de nombreuses lianes pour haies, barrières ou portiques, tonnelles ou berceaux, des plantes crassulescentes dites "plantes grasses," des plantes aquatiques et des plantes d'intérieur, des épiphytes avec Orchidées, Aracées et Broméliacées. Parmi les fruitiers susceptibles d'amélioration, des sapotilles (*Achras*), sapotes (*Pouteria*) et cerises antillaises (*Malpighia*) riches en vitamines C.

STEIN, OTTO L., and D. M. STEFFENSEN. Montana State University and Brookhaven National Laboratory. *The Distribution of Radiation-induced Genetic Markers in Leaves of Zea and Its Relation to the Activity of the Shoot Apex.* Corn embryos, heterozygous for the color gene yellow-green (yg_2) were irradiated with moderate doses of X-rays. The distribution of the yellow sectors produced by the loss of the dominant gene was studied in the leaves of the seedling. The frequency of the sectors per leaf reflected the stage of development of the embryo as well as subsequent production of leaves by the shoot apex. The embryonic leaves which are fairly large at time of radiation show many short sectors, while those closer to the primordial state exhibit fewer but longer sectors. The first three leaves formed after germination showed a linear response to dose with respect to frequency of sectors. Still younger leaves show a saturation effect, that is, no additional sectors can be found after certain dose limits have been attained. The results indicate that (1) the shoot apex of corn ordinarily has within itself the meristematic capital for about three future leaves, and (2) once these cells have been worked out of the apex by cell division the remaining meristematic cells at saturation doses will carry the maximum load of genetic damage that a cell can carry and still continue normal processes. Efforts to modify this system will be discussed.

STEINER, ERICH. University of Michigan. *The Role of Incompatibility in the Complex-heterozygotes of Oenothera.* A survey of complex-heterozygotes belonging to four different phylogenetic groups of the subgenus Euoenothera has shown that in most forms the alpha complex (the genome transmitted through the egg) carries an incompatibility allele. This allele functions as a pollen lethal in the balanced lethal system. The presence of incompatibility alleles in these forms introduces a new dimension in the interpretation of the highly specialized cytogenetic mechanism of *Oenothera.* That incompatibility alleles occur in several phylogenetic groups adds support to the hypothesis that the complex-heterozygote originated through hybridization of a self-incompatible population with a self-compatible population, each differing in the end arrangement of its chromosome complement. The evolution of each phylogenetic group of complex-heterozygotes is considered with special reference to the incompatibility system.

STEVENSON, I. L. Microbiology Research Institute, Canada Department of Agriculture. *The Effect of Decomposing Plant Residues on the Metabolic*

Activity of the Soil Microflora. Studies have been undertaken to determine the metabolic activity of the soil flora *in situ* during the decomposition of six green manure crops. The methods used included the determination of bacterial numbers, dehydrogenase activity, and oxygen uptake with selected substrates (ethanol, amino, and organic acids). Tests were carried out at frequent intervals during a 66-day experimental period. Bacterial populations in the amended soils rapidly reached a maximum in five to ten days. A rapid decline in numbers occurred until the twenty-fifth day, after which numbers remained relatively constant at a level higher than in the unamended control soil until the end of the experiment. As a rule dehydrogenase activity and endogenous respiration (oxygen uptake) of the soils paralleled fluctuations in bacterial numbers. The oxidation of ethanol, amino, and organic acids was followed by conventional soil-Warburg techniques. Greatest stimulation of the soil flora was observed with oats, red clover, alfalfa, and flax. Analyses of the data for the period of maximum activity (one to ten days) suggested that the increased oxidation of the substrates by the supplemented soils was due to a preferential stimulation of certain organisms and not simply to the increased population. During this same period the residues of wheat and timothy caused a depressant effect on oxidation.

STEWARD, F. C. Cornell University. *Growth Substances of Endosperm and Their Action.* The standard assay test for substances which promote cell division in otherwise resting cells will be described, with special reference to the stimulating effect of coconut milk, or the liquid endosperm of the coconut, on both tissue explants from the phloem of the carrot root and free cells. The use of the test to measure increase in weight, cell number, and average cell size will be described. Various sources of this activity will be noted and their morphology outlined. The present status of the isolation and identification of the chemical substances responsible for the cell division promoting activity will be described with special reference to (*a*) the liquid endosperm of the coconut, (*b*) extracts from immature corn grains, (*c*) extracted fluid and tissue extracts from immature *Aesculus* fruits. From each system distinctive substances have been obtained and identified, but there is one substance or kind of substance that is solely responsible for the control of cell division. Substances that interact with the cell division factors proper will be mentioned, for they lead to ideas upon the regulatory control of cell division by chemical means. Lastly it will be shown that, when appropriately stimulated by these agents, free cells will give rise to whole plants.

STEWARD, F. C. Cornell University. *Present Concepts of the Free Amino Acids of Plants and Their Role.* Some outstanding contributions which have been made by the use of chromatographic methods to our knowledge of the nitrogen compounds which occur free in plants will be summarized. This summary will indicate the range of the compounds which are now known to occur. Some selected examples will be used to illustrate the biogenesis of the compounds in question. Reference will be made to the effect of environment and nutrition upon the pool of soluble nitrogen compounds and to the way in which this pool may be related to protein synthesis.

STEWART, WILSON N. University of Illinois. *Origin of Vascular Plants: Monophyletic or Polyphyletic?* Recent papers by Leclercq (1954) and Andrews and Alt (1956) emphasize the diversity of the Devonian floras. Andrews and Alt interpret this diversity as evidence for the polyphyletic origin of vascular plants from "several groups of algae." This, they claim, explains the great variability of morphology and anatomy found among the Devonian lycopods, articulates and "psilophytes." The trend toward polyphyletic classification of vascular plants was emphasized by H. C. Bold (1957) who published a classification in which vascular plants are placed in one of nine different divisions. By contrast A. S. Foster and E. M. Gifford (1959) have adopted the monophyletic classification of vascular plants compiled by Tippo (1942). In view of this increasing divergence of opinion with respect to vascular plant classification, that is, monophyletic *vs.* polyphyletic, a re-evaluation of the physiological and morphological evidence seems to be in order. This re-evaluation provides for an analysis of paleobotanical evidence interpreted in the light of the telome concept; it also provides for reinterpretation of fossils which have been championed as constituting supporting evidence for the polyphyletic origin of vascular plants. Finally, the revival of the monophyletic classification based on the proposal of Conard (1939) is suggested.

STEYN, WILLEM J. A. Rhodes University, South Africa. *The Errors Involved in the Sampling of Citrus and Pineapple Plants for Leaf Analysis Purposes.* A statistical study of the variations in nitrogen, phosphorus, potassium, calcium, magnesium, iron, manganese, zinc, and copper in the leaves of Navel citrus trees and Cayenne pineapple plants is presented. The following variations occurred: in a single plant from sunrise to sunset on the same day; amongst the leaves on single plants; from plant to plant in small areas; and from location to location in large areas. The variations were treated statistically and tables of sampling intensity for specific levels of accuracy are presented. It is shown that, if the nutrient elements are to be represented adequately, much more intensive sampling than hitherto practised would be necessary. Reliable sampling procedures are suggested for these two crops.

STILLE, B. University of Bonn. *Response of Micro-organisms to Root Excretions.* Es werden in grösseren Zügen die besonderen ökologischen Verhältnisse innerhalb der Rhizosphäre erörtert und die wesentlichsten bisherigen Angaben über den Nachweis *echter* Wurzelausscheidungen behandelt. An Hand charakteristischer Beispiele wird auf die zahlenmässige und räumliche Verteilung von Mikroorganismen innerhalb des Wurzelbereiches und das Vorkommen und die quantitative Verschiebung einzelner Mikroorganismenarten eingegangen. Anschliessend wird über die bisherigen Einblicke in die physiologische Aktivität der Mikroflora der Rhizosphäre berichtet und nachgewiesen, dass die üblichen Ermittlungen von Keimzahlen nur sehr bedingte Rückschlüsse auf das tatsächliche Ausmass des Stoffumsatzes innerhalb des pflanzlichen Wurzelbereiches gestatten. Es folgen Angaben über die Verdrängung bestimmter Mikroorganismenarten aus der engeren Rhizosphäre durch hemmende Wurzelausscheidungen und konkurrierende bezw. antagonistische Bodenmikroben.

STILLER, MARY. University of Chicago. *Effects of Fluoride on the Metabolism of Acid-grown Chlorella.* Warburg and co-workers (Z Naturforschg. *11b*:718, 1956; *12b*:3, 1957; Naturwiss. *11*:237, 1956) have reported the "activation" *in situ* of a specific L-glutamic acid α-decarboxylase in acid-grown cells of *Chlorella;* the addition to the cells of sufficiently high concentrations of NaF or lactic acid resulted in a heat-labile, cyanide sensitive evolution of CO_2 from the cells, concomitant with the loss of glutamate and the appearance of its decarboxylation product, gamma-amino butyrate. Vishniac and Fuller (Federation Proc. *17*:328, 1958) have reported the occurrence of this reaction in cells of *Euglena, Chlorella,* and *Scenedesmus,* and shown the ready "reversibility" of the glutamate decarboxylation in the living cells of *Euglena.* The earlier workers interpret these and other data as implicating the participation of glutamic acid in the mechanism of photosynthesis in *Chlorella.* From their studies of the fluoride-induced CO_2 evolution, Bishop and Gaffron (Arch. Biochem. Biophys. 28:36, 1958) have concluded that the phenomenon bears no relation to the mechanism of photosynthesis. This paper will describe attempts to reproduce the results of all three groups of investigators.

STOCKING, C. RALPH. University of California. *The Incorporation of Thymidine into Chloroplasts.* Reports on animal tissues and on non-green tissues of higher plants have indicated that in low concentration thymidine is effectively utilized in the biosynthesis of desoxyribonucleic acid without diversion of radioactivity into other compounds. The present paper reports the results of incubating living *Spirogyra* filaments in nutrient solution containing tritiated thymidine. Histo-autoradiograms reveal a concentration of the radioactivity in the chloroplasts. This activity remains after treatment with desoxyribonuclease. The significance of the binding of thymidine to the chloroplasts will be discussed.

STOLL, CH. *See* MANIGAULT, P., *et al.*

STONIER, TOM. The Rockefeller Institute, New York. *Production of an Antibiotic Agent by Agrobacterium tumefaciens.* Two strains of *Agrobacterium tumefaciens* (Smith and Townsend) have been found to produce an antibacterial agent. The agent diffuses rapidly through agar, is dialyzable, and unstable at 25°C. The effect of the agent is completely reversed by certain amino acids and particularly by peptides of alanine. Possible relations of this agent to the tumor-inducing capacity of the bacteria are discussed.

STOUTAMIRE, W. P. Cranbrook Institute of Science, Bloomfield Hills, Michigan. *The Exploitation of Several Evolutionary Mechanisms within a Genus.* The genus *Gaillardia* comprises approximately fifteen species of plants which exhibit a number of evolutionary processes. Hybridization has led to new species, one example within the past century. Two species include diploid and polyploid races, and a third species comprises a number of cytological types which are not morphologically distinguishable. Many geographical races differ in their rates of development although equivalent growth stages are morphologically similar. Differentiation is occurring by several mechanisms, probably in response to wide variations in ecological conditions over large species ranges.

STROUN, M. University of Geneva. *Relationship between the Length of Day, the Light Spectrum, and the State of Differentiation of Floral Primordia in Long-day Cereals.* Research done with lamps of different wave-lengths, red, blue, and white, show that in long-day cereals the requirements of plants with regard to the spectral quality of light are different according to the daily photoperiodic rhythm and the state of development of the floral primordia. For example, with 24 hours of daily light, in general, no significant difference is observed in the speed of differentiation of the floral primordia in plants developing in white, red, or blue light. With 9 hours of daily light, the appearance of the first differentiation of the growing point is slightly retarded in plants under blue light compared with plants under white or red light. However, after segmentation of the developing cone has taken place, this delay in the speed of differentiation of the floral primordia is accentuated, reaching a maximum (sometimes as much as a month in our experimental conditions) at the time when the plants under white or red light simultaneously reach the gonadogenesis stage. At this point, the plants under white or red light evolve extremely slowly, permitting the plants under blue light to overcome to a great extent their retardation. The alternation of red and blue light, or vice versa, during the reduced daily photoperiod is unfavorable to the formation of floral primordia.

Stroun, M., and R. Cortesi, University of Geneva. *Multiple Fertilization in Mirabilis jalapa L.* A control of the monospermal phenomena in fertilization has been taken up by the study of the effects of pluri-paternal fertilization in descendants. A white, a yellow, and a red variety of *Mirabilis jalapa* L. were used. In the first generation (F_1), a white variety fertilized with the pollen of a yellow plant gives a yellow hybrid. A white variety fertilized with the pollen of a red plant gives a red hybrid; a yellow variety fertilized with the pollen of a red plant gives an orange-red hybrid. The white variety fertilized with the pollen of both a red and a yellow plant gives an orange-red hybrid. In the second generation (F_2), the simple crossings show a normal segregation between the two progenitors. In the bi-paternal plants, a segregation which allowed the appearance of the characteristics of the two male progenitor plants in addition to those of the female variety, was observed. Therefore, we cannot neglect the hypothesis that there is an action on the genome by the ovular cytoplasm, by the embryo-sac cells, and by the surrounding cells having assimilated the other spermatozoids.

Struckmeyer, B. Esther. *See* Roberts, R. H.

Stuart, Neil W. Crops Research Division, U.S. Department of Agriculture. *Accelerated Growth and Flowering of Hydrangea macrophylla by Foliar and Soil Applications of Gibberellin.* Soil applications of potassium gibberellate in water solution or diluted with talc and attapulgite stimulated stem growth and dry-weight accumulation in plants of *Hydrangea macrophylla.* When a water solution containing 1 μg. per ml. each of gibberellin and of indole acetic acid was applied to the terminals weekly, starting August 8 (prior to flower initiation), plants of the Sainte Therese variety did not become dormant but flowered without exposure to low temperature. Dormant plants with initiated flower buds bloomed after defoliation and five weekly spray applications of 20 μg. of gibberellin to the terminals. Without defoliation prior to application of gibberellin, the new leaves produced were chlorotic and had necrotic margins. Single applications to the soil of 10 to 20 mg. of gibberellin per plant produced similar results. Proportionally smaller amounts of gibberellin could replace any portion of the dormancy-breaking low-temperature requirement. Over-treatment with gibberellin resulted in the production of excessively elongated stems, thin leaves, and loose inflorescences with pointed sepals.

Stubbe, Wilfried. Universität Köln. *Genetic Analysis of the Correlation between Different Genomes and Plastomes in Oenothera.* The plastids of 12 wild species of Oenothera were compared with regard to their genetic information (i.e., plastome) under the condition of identical genomes. Five kinds of plastomes can be distinguished: I (Hookeri), II (suaveolens), III (Lamarckiana), IV (parviflora), V (argillicola). Their phenotypic effects concern the green pigmentation depending on the structure of the chloroplasts, the germination of the pollen or the growth of the pollen tube, the shape of the starch grains of the pollen, and the relative multiplication frequency of the plastids. These plastome controlled characters mutate independently, giving evidence for a complex structure of the plastome. As recombinations are unknown, we tried to investigate the relationships between unequal plastomes by means of their phenotypic expression in the presence of various genomes. Parviflora plastids which are widely adapted to the majority of different genomes, permitting normal function of the chloroplasts, are regarded as the original type from which the remaining plastid types may have arisen. This is confirmed by the fact, that these plastids divide most slowly as compared with others. Cleland's phylogenetic pedigree of Euoenothera, based on genome similarities, may be completed now by a corresponding one for the plastomes. Due to their cooperation with the plastomes in respect to the green pigmentation of the plants, the Oenothera genomes can be subdivided into three groups "A, B, C." These correspond to three groups of genomes characterized by morphological features. "A" inherits the Hookeri-strigosa-phenotype, "B" the biennis-phenotype, "C" the argillicola-β-parviflora-phenotype.

SUBBA-RAO, N. S., and V. SLANKIS. Canada Department of Agriculture. *Indole Compounds in Pine Mycorrhiza.* It is now known that some auxins such as indole-3-acetic acid, when applied at relatively high concentrations to aseptically growing cultures of excised or intact roots of pine seedlings, induce morphological changes simulating the coralloid nature of pine mycorrhiza. In an attempt to demonstrate the presence of indole compounds in pine mycorrhiza formed in nature, whole root systems of two-year-old white pine seedlings were treated with reagents known to react with indole derivatives. Of the reagents tested, Ehrlich's reagent (p-diaminobenzaldehyde in IN. HCl) imparted intense red colouration to mycorrhizal short roots and the swollen ends of mycorrhiza-bearing mother roots. The presence of indole compounds in mycorrhizal roots was also demonstrated using filter-paper chromatography technique. None of the short roots of a four-month-old pine seedling growing aseptically showed the characteristic intense red colouration when treated with the reagent. Therefore, it is presumed that the observed predominance of indole compounds in mycorrhizal roots is a result of interaction between the symbionts.

SUCHORUKO, K. T. Academy of Sciences, Moscow. *Respiration of Diseased Plants.* Many experiments have shown that the respiration of plants usually is increased by injury or the onset of infectious diseases. The author has shown that a decrease in the respiratory quotient (R.Q.) accompanies this increase in respiration in diseased plants. He believes that respiratory intensity and the respiratory quotient can be taken as an index of the level of oxidative synthesis occurring in the organism, and that hence the oxidative processes are reduced in diseased plants. This disturbance in the normal balance between oxidations and syntheses must inevitably lead to an increase in the transformation of chemical energy into heat, with a reduction in the efficiency of the cell syntheses. Direct calorimetric determinations confirmed the assumption that the increased respiration of the infected plants is accompanied by an increase in the liberation of heat; at the same time a decrease in the efficiency of the synthetic processes is observed. The R.Q. progressively decreases in the dying tissues and reaches zero at the moment of death. When a plant is killed, if death ensues rapidly or instantaneously, there is a sharp increase in the absorption of oxygen and a slight increase in the liberation of carbon dioxide. Experiments on respiration and the histological study of the dying tissues lead to the conclusion that the terminal cause of death is the oxidative destruction of the plasma. Quantitative and qualitative studies of respiration permit one to measure the degree of the disturbance in the diseased organism and to make a prognosis of its future development.

SUKACHEV, V. Academy of Sciences, Moscow. *The Correlation between the Concepts "Forest Ecosystem" and "Forest Biogeocoenose" and Their Importance for the Classification of Forests.* The concepts "ecosystem," suggested by Tensley, and "biogeocoenose" are alike in that both concern the complex of organisms (biom) together with the complex of physical and geographical factors of the environment. But the ecosystem, according to Tensley, denotes one of the categories of the various physical systems of the universe, remaining by itself as an abstract concept (J. Major, 1958). On the contrary, the "biogeocoenose" cannot be considered a general term applicable to all taxonomic subdivisions of the vegetation, but must be used for defining a definite plot of the earth's surface, an empirical object of the study which covers the whole complex of biogeocoenose, consisting of phytocoenose, zoocoenose, and microbiocoenose with corresponding parts of atmosphere, lithosphere, hydrosphere, and pedosphere, the interaction of which remains constant on the full length of the plot. The term biogeocoenose may be considered more suitable than ecosystem as it stresses the general unity of live organisms with the inanimate nature of the earth's surface. The main unit for classifying the forests is the forest type which unites the separate forest biogeocoenoses, which are homogeneous in the composition of forest tree species, in the other layers of vegetation, in the fauna, in the complex of environmental factors affecting the growth of forest (such as climate, soil, and hydrology), in the interactions between all the components of the biogeocoenose, and consequently they are homogeneous in the processes of the restoration, successions, and growth of tree species. When the term forest type is understood as described above, all the plots of the forest which are considered to belong to the same type, provided there exist similar economic conditions, will require similar forest management. Therefore, the classification of forests based on the described principles has theoretical and practical advantages.

SULLIVAN, CHARLES, and J. LEVITT. University of Missouri. *Nitrogen Metabolism as Related to Drought Resistance of Sempervivum glaucum. Sempervivum glaucum* is one of many succulent species that will survive many months when removed from its external water supply. Survival has been largely attributed to avoidance of loss of stored water by a thick cuticle. True as this may be, the plant would die much sooner were it not for internal water movement from the older leaves to the younger leaves and roots. It was observed with older excised leaves that water movement was always from the tip to the base of the leaf when root formation or other new tissue formation was present. Numerous investigations failed to explain this movement as being due to an osmotic gradient or diffusion pressure deficit differences. Previous experiments determined the critical saturation deficit of leaf tissue. Analysis of excised leaves for soluble and insoluble nitrogen indicates protein hydrolysis in the top half with resulting transport of soluble nitrogen to the basal half where it is resynthesized in the formation of new roots. Nitrogen transport and root formation were blocked by cutting the leaves in half and covering the cut surfaces with a layer of petrolatum. Following the water movement of these same leaves indicates that the tip cells of whole excised leaves die before the critical saturation deficit is reached. Thus, their water content is freed to move with the amino acids to the living cells.

SURREY, KENNETH. Argonne National Laboratory, Lemont, Illinois. *Azo-coupling Reaction for Secondary Amino (Imino) Groups of Proteins in Plant Tissue.* The work is based on the selective behavior of nitrous acid towards imino groups forming nitroso-amine (N-nitroso) derivatives which when treated with acid are decomposed, yielding nitrous acid and imino groups. Nitrous acid thus produced diazotized arylamines which coupled with its undiazotized molecule, forming a bright dye at the sites of nitrous acid liberations. Alpha-naphthylamine and its methyl and ethyl derivatives were found to be suitable reagents. Evaluation of diffusion of the dye from tissue sections as a function of acid strength was also determined. The absorption maximum of the purple dye produced by diazotization and coupling of alpha-naphthylamine in the tissue sections occurs at 545 mμ. Maximum nitrosation was found when the ratio of equinormal volumes of $NaNO_2/HCl$ was 7:3. Although the method appears to be appropriate for the detection of proline and hydroxyproline, which exhibit typical reactions of secondary amines, the inclusion of other tissue components having -NH- groups could not be ruled out, including peptide linkages.

SUSSEX, IAN M. University of Pittsburgh. *Control of Development of Excised Fern Leaves in vitro.* Excised leaf primordia of *Osmunda cinnamomea* mature in sterile culture, responding to variations in composition of the medium by developmental alterations which can be expressed quantitatively. Height, weight, pinna, and pinnule number, pinna area, and the number of epidermal cells in the pinna all increase with increasing sucrose concentrations to maximal values at or below 3 per cent sucrose. Cell size decreases with increasing sucrose level, but the change is not directly proportional to the sucrose concentration. Addition to these media of various growth-regulatory substances may alter quantitatively the above characters of the leaf and may also accelerate or retard the rate of development. The duration of meristematic growth of the leaf, and the size and number of its component cells are important factors in determining the size and shape of the leaf.

SUSSEX, IAN M. *See* CLUTTER, MARY E.

SUSSMAN, MAURICE. *See* SUSSMAN, RAQUEL R., *et al.*

SUSSMAN, RAQUEL R., HERBERT L. ENNIS, and MAURICE SUSSMAN. Brandeis University, Massachusetts. *Cellular Differentiation and Slime Mold Aggregation.* The myxamoebae of *Dictyostelium discoideum* can be classed as I-cells and R-cells by morphological criteria and can be counted differentially with precision.

Previous work had indicated that the I-cells are the initiators of aggregation, that is, the cells that induce their neighbors to aggregate. Examination of exponentially growing populations has revealed the presence of I-cells in a steady state ratio of I-cells to R-cells of approximately 1 : 2,000. Clones derived from R-cells invariably include I-cells and vice versa. The formal statement of this relationship is: R-cells $\underset{k_2}{\overset{k_1}{\rightleftharpoons}}$ I-cells, such that in the steady state condition, $k_1/k_2 = 1/2{,}000$. Studies have been made of the rate of disappearance (k_2) of the I-cell phenotype in clones derived from I-cells. A modification of the Luria-Delbruck null method for mutation rate measurement permitted an estimate of the rate (k_1) of appearance of I-cells in clones derived from R-cells. The equilibrium ratio predicted by these data is very close to 1 : 2,000. Time lapse cinematography of I-cell fissions has revealed a high frequency of aberrant divisions. About 10 per cent of the clones derived from I-cells show heritable anomalies. The results indicate that the transformation of R-cells to I-cells may involve a change in the genetic apparatus.

SUTCLIFFE, J. F., and R. G. HURD. King's College, University of London. *Active Absorption of Bicarbonate Ions by Vacuolated Plant Cells.* In washed slices of some storage tissues (e.g., beet root, parsnip root) the apparent excess of cations over anions absorbed from solutions of KCl is increased at alkaline pH, and the effect is associated with absorption of bicarbonate ions. Uptake of potassium ions from solutions containing mixtures of KCl and $KHCO_3$ is about equal to the uptake of chloride and bicarbonate ions together. Other tissues (e.g., potato tuber, swede hypocotyl) absorb bicarbonate ions appreciably only in the absence of other absorbable anions, perhaps because bicarbonate ions compete unsuccessfully with other anions for a common absorption mechanism. It is suggested that cations are absorbed into the cytoplasm either by exchange involving hydrogen ions which are ultimately derived from a CO_2 fixation mechanism; or in accompaniment with anions, including bicarbonate. If the latter are absorbed, they are converted to organic acid anions, presumably in the cytoplasm, and subsequently transferred together with an equivalent number of cations, into the vacuole.

SUTTON, C. E. *See* BUCHINGER, MARIA

SVENSON, HENRY K. U.S. Geological Survey. *Cyperaccae in North America.* Distribution and morphology of sedges, chiefly species of *Eleocharis* and *Fimbristylis* of the eastern United States, and their derivation from tropical species, will be discussed. Changes appear in cellular reticulation of the achene and in cross-section of the stem (culm) in the transition from tropical to temperate species.

SYLVESTER, EDWARD S. University of California. *Types of Plant Virus Transmission by Aphids.* Aphid-borne plant viruses are commonly put into one of two groups, persistent or non-persistent. Members of the latter group, which includes many of the herbaceous mosaics, are thought to be transmitted by the adherence to and subsequent removal of infectious units from aphid stylets during brief plant tissue penetrations. This process has been termed "mechanical" transmission, but to analogize it to needle inoculation is somewhat misleading.

Persistent aphid-borne plant viruses can be subdivided into persistent and semi-persistent types. This convenient division may be of no significance other than as an arbitrary division of degree. The mode of transport is believed to involve removal of virus from the plant during feeding, translocation of it within the aphid, and subsequent expulsion of it as feeding continues. This sequence of events occurs more slowly than in "mechanical" transmission, and the inoculative capacity of the aphid may be demonstrable over relatively long periods of time. Whether or not these various types of transmission are specifically mutually exclusive, or if they are related to the basic phylogeny of plant viruses remains to be seen. Recent evidence does not deny that positive evidence regarding the type of transmission may be of value on this level, but it does suggest that negative evidence, that is, failure to obtain transmission, may be a non-decisive characteristic.

SYMINGTON, JANEY S. *See* LIPPINCOTT, JAMES A., *et al.*

SZAFER, WLADYSLAW. Jagiellonian University, Krakow. *A Miocene Flora on the Shore of the Parathetys Sea in South Poland.* The author demonstrates with twenty tables the floristic composition of Upper Miocene (Tottonian) from South Poland. About six hundred photos illustrate the richness and diversity of the taxons. The very well-preserved fossil fruits and seeds formed the basis for a detailed examination not only of the morphological, but also of the anatomical characteristics. In many cases it was possible to study the variability of fossil specimens in comparison with their nearest living species. Two charts and two diagrams (one of which is a pollen analytical diagram) enable one to study the origin and historical development of the fossil flora, as well as its ecological features, which were determined by the changes of climate, and by the transition of the salt-water basin to a fresh-water one.

SZCZAWINSKI, ADAM F., and VLADIMIR J. KRAJINA. Provincial Museum of British Columbia and University of British Columbia. *Corticolous and Lignicolous Synusiae of the Forest Phytocoenoses in the Coastal Douglas-fir Zone on Vancouver Island.* Ecoclimate of forest phytocoenoses may contain one or several microclimatic strata expressed by characteristic corticolous and lignicolous synusiae pertaining to these phytocoenoses. In the wet β-gley soils of the Douglas fir–western redcedar–swordfern association, the microclimatic stratification, indicated by the corresponding synusiae, is most complex. Here the ecoclimate is subdivided into four microclimatic strata. (1) The lowest stratum, expressed by corticolous and lignicolous bryophytic synusiae between the ground and approximately 2 m. above it, is most characteristic for this forest phytocoenosis. (2) The second stratum, overlying the first, by the microclimatic characteristics and corticolous bryophytic synusiae, resembles the lowest stratum of the Douglas fir–western hemlock–moss association, growing on somewhat drier γ-gley soils. (3) The third stratum, situated above the second one, usually about 25-30 m. above the ground, is characterized by the corticolous lichen synusia, similar to the lowest stratum of the Douglas fir–salal association growing on still drier concretionary (reddish) brown podzolic soils. (4) At tree heights between 50-65 m., the uppermost (fourth) stratum occurs, expressed by epiphytic lichen synusia resembling the lowest stratum of Douglas fir–salal–lichen association on the driest shallow brown podzolic soils.

SZWEYKOWSKI, JERZY. A. Mickiewicz University, Poznan, Poland. *The Variation of Orthocaulis atlanticus in Europe.* The biometrical method published by Szaferowa (Kosmos *66*, 1948-51) was used for investigating the variation of this critical species. About 30 herbarium specimens from Scandinavia, Finland, Sweden, Norway, Great Britain, and the Tatry Mts. of Poland were compared with each other and with related species of *Orthocaulis* (*O. binsteadii, O. attenuatus, O. floerheii*). Fifty leaves from different stems were taken from each specimen. In each leaf several characters (such as length of lobes, length of marginal cells, and breadth of whole leaf) were measured. In addition, several ratios indicating the shape of the leaf lobes, the deepness of the leaf incision, the shape of the leaf, etc., were computed. After the arithmetical means had been calculated for each character and for each specimen, comparison units were chosen. Then the arithmetical means of each specimen were divided by the arithmetical means of the comparison unit and the obtained values were put into a diagram resulting in a "line of shape." In this manner it is shown that *O. atlanticus* can be distinctly delimited from the related species mentioned above and that the European material of *O. atlanticus* falls into two groups: small-celled and great-celled. The small-celled group contains the type specimen of *Jungermania atlantica* Kaslaas.

TABER, W. A. Prairie Regional Laboratory, Saskatoon, Saskatchewan. *Nutrition and Morphogenesis of the Synnema.* Two morphogenic types of synnemata exist: those which produce spores at the apex are classified as having determinate growth; those which produce spores at the base and possess an apical growing point are classified as having indeterminate growth. A direct comparison of a representative of each, *Graphium ulmi* and *Isaria cretacea,* has not revealed fundamental differences in response to environmental and nutritional factors. Neither phototropism nor geotropism is required to initiate formation of synnemata although mature synnemata of *I. cretacea* are phototropic. The exogenous nitrogen source is not an important factor, but the carbon source is important. The vitamins required by *I. cretacea* for growth are required in certain concentrations for synnemata development, but this is not entirely independent of general colony growth. The synnemata of *I. cretacea* are capable of rapid vertical translocation of C^{14}-labeled nutrients, but the colony hyphae are not, and thus translocation may be an important factor. The insect pathogen, *Hirsutella gigantea,* appears to be different from the above fungi since light and the nitrogen source are important while the carbon source is not. The concentration of carbon and nitrogen is, however, important.

TABORDA DE MORAIS, ARTUR. Instituto de Investigação Científica de Angola. *O crescimento da Adansonia digitata.* No centro e norte da Província de Angola, os indígenas arrancam na base do tronco da *Adansonia digitata,* junto ao solo, anéis do cortex, geralmente com a altura de 1 metro, para lhes extrair da face interna fibras texteis destinadas à fabricação de vários objectos empregados na sua vida doméstica; no sul da Província, os elefantes tambén arrancam o cortex da mesma espécie apenas para o mastigar e chupar, des sedentandose assim com o líquido que ai encontram. Com o andar dos séculos estas feridas—umas e outras—vão aparecendo a níveis cada vez mais altos do que aquele em que primitivamente foram feitas. No caso das antropogenicas, uma vez a scendida a primeira, os indígenas fazem segunda por debaixo daquela, depois terceira, quando a segunda, acompanhando a primeira, houver ascendido, e assim por diante. O caso extremo, observado pelo autor, apresentava oito andares de cicatrizes, alcançando o bordo superior de mais elevado a altura de 9 metros acima do solo!

Tageeva, S. V. Academy of Sciences, Moscow. *Peculiarities of the Motion and Viscosity of the Protoplasm of Vegetative Cells.* The physiological role of the motion of protoplasm in vegetative cells is not yet fully understood. But it is definitely an important element in the mechanism of the interaction between cells, and promotes transport and metabolism between them. This finds confirmation in the more intensive movement of protoplasm in the cells of the conducting tissue of the *Elodea* leaf as compared with the motion of protoplasm in the cells of the mesophyll, and also in the cessation of motion in the case of a certain degree of dehydration of the protoplasm. The forces that bring about the motion of the protoplasm of vegetative cells have common features with the mechanism of the contractile motions of the proteins of muscular cells where the macroenergetic phosphate bonds of adenosine triphosphate (ATP) are the source of energy. The epidermal cells of onion, in which the motion of protoplasm stops under the action of a brief irradiation with ultraviolet rays, renew the movement of the protoplasm when placed in a solution of ATP. Continued irradiation of the tissues of *Elodea* in the blue-violet region of the spectrum intensifies movement and extends the time of its active manifestation following separation of the leaves from the plant. This may be due to photoactivation of systems that determine the exchange of energy in the cells. The state of the structural viscosity of the protoplasm of vegetative cells is an important factor determining the vital activities of the protoplasm and closely connected with the motion of the protoplasm. The action of such an ecological factor as light of different intensity and of various spectral regions produces considerable alterations in the viscosity of the protoplasm. There are also observed simultaneous changes both of the viscosity of the protoplasm and of the activity of growth processes. Studying the motion and physico-chemical state of the protoplasm of cells enables one to penetrate deeper into the mechanism of the most important vital processes of plants.

Takahashi, Nobuo. Mamurogawa, Japan. *On the Change in the Flora of the Neocene Tertiary in Tohoku (Northeast Part) District of Japan.* Thirty pollen diagrams studied in the Neocene Tertiary in Tohoku (the Northeast Part) district of Japan show us the vertical migration of the flora and the climatic change represented in each stratum. Taking as an example Yamagata, Akita, or Niigata prefectures in the coast of the Japan Sea, we find five periods in the Miocene: *Sequoia, Liquidamber, Quercus-Taxodium, Alnus-Fagas, Cunninghamia-Taxodium*; in the Pliocene, two periods: *Cunninghamia, Alnus-Fagas* (from the base). From the above-mentioned we recognize a different climate in each period.

Takata, K. *See* Oota, Yukito

Takhtajan, Armen L. Academy of Sciences, Leningrad. *Major Features in the Evolution of the Eurasian Tertiary Angiosperm Floras.* The primary centre of development for the angiosperm floras of Eurasia was probably the mountain regions of Southeast Asia. Before their rapid expansion in the middle of the Cretaceous, the angiosperms had already attained in that area great ecological and morphological diversity, and had formed a series of basic zonal types of vegetation. Therefore, when they had the possibility for wide distribution over the world, they spread differentially, along various migration routes and in different ecological channels. In the Upper Cretaceous not only were latitudinal zones expressed in Eurasia, but also a clear regional differentiation within these zones was apparent. The main differences between holarctic and tropical floras were already manifest in the Upper Cretaceous. All the subsequent history of the Eurasian Tertiary floras is characterized by their increasing zonal and regional differentiation. During their whole history, Europe and Northern Asia remained within the limits of Holarctica, and only in the Eocene did some tropical elements penetrate into Europe (especially Western Europe) to the north. There was no true tropical latitudinal zone in Europe during the Tertiary, only a few small enclaves of tropical vegetation. The author means to analyse the main stages in the evolution of the Eurasian Tertiary floras.

TALAGEANU, NICOLAE. Bucuresti, Roumanie. *Sur l'état du protoplasme et l'intensité de la photosynthèse.* En introduisant la solution Warburg et des plantes vertes dans la chambre de respiration de microrespiromètre de Thunberg-Winterstein, j'ai determiné le O_2 consumé dans la respiration, ainsi que le O_2 produit dans la photosynthèse à l'intervalle de temps de 5-10 minutes. La photosynthèse diminue avec le temps, chez les branches d'*Hélodea canadensis* et de *Myriophyllum verticillatum* immergées dans l'eau de source à 44°C., les plantes se trouvant après 30-40 minutes, au point de compensation. La photosynthèse cesse complètement pendant les 60-90 minutes suivantes. Les courants protoplasmatiques cessent avant la photosynthèse. La plasmolyse en solution de KNO_3 m. solides 2, montre des cellules mortes non plasmolysées après 15 minutes. Leur nombre s'accroît de plus en plus avec le temps. Après 60-90 minutes, toutes les cellules sont mortes. La mort des cellules s'étend progressivement du bord de la feuille à la nervure médiane et de la pointe de la feuille vers sa base. Le nombre des cellules vivantes diminue parallèlement avec l'intensité de la photosynthèse, qui cesse à la suite de la mort de toutes les cellules. Les feuilles de peuplier, de sureau, de géranium, de tomate, d'haricot, tuées en les desséchant à la température de la chambre, à la suite de l'humectation, absorbent à la lumière de l'oxygène comme à l'obscurité. Le phénomène de la photosynthèse n'a pas lieu chez elles.

TAMIYA, H. *See* OH-HAMA, T., *et al.*

TATEOKA, T. National Institute of Genetics, Japan. *On the Phylogenetic Difference between Lepturus and Monerma.* *Lepturus* and *Monerma* are so closely related in the characters of inflorescence, spikelet structure, glume, lemma, etc., that they were treated as congeneric at one time. But, several authors pointed out that they are quite different in histological and anatomical features and also in geographical distribution. Their phylogenetic difference will be discussed from the viewpoint of cytology and morphology. The characteristics of flower proper and caryopsis of *Lepturus* imply various indications of the close relationship of the genus to the typical members of Eragrostoideae. The same is true of *Monerma* to Pooideae. The relationship of *Lepturus* to Eragrostoideae and that of *Monerma* to Pooideae are reflected in morphology, even though not in features customarily considered as important in traditional systematics.

TATEWAKI, M. *See* YAMADA, YUKIO

TAYLOR, A. R. A. University of New Brunswick and Fisheries Research Board of Canada. *Growth of Chondrus crispus (L.) Stackh. in a Submersed Population.* On the north shore of Prince Edward Island, Canada, *Chondrus* grows totally submersed. Growth of individual submersed specimens, as rate of increase in area, was measured there for four years. The rate of growth is slow, about 0.01 $cm.^2/cm.^2$/day during the summer. It is at a maximum in late spring and decreases through the later part of the summer to a minimum in winter. Areas of individual specimens were measured by bringing the rocks on which they grew to the surface and photoprinting the individuals with Ozalid paper. In this way a plant could be measured over a period of months or years until it was lost, damaged, or became too large to be printed; areas on the prints were measured with a planimeter. The growth rate, as increase per unit area, was found to be of the same order for young fronds as for older ones, and for specimens in other areas of the same latitude but in very different hydrographic conditions. The composition of the population was described in terms of size-development classes. The natural population contained 85 per cent by weight of harvestable specimens, but this comprised only 30 per cent of the individuals.

TAYLOR, WM. RANDOLPH. University of Michigan. *Distribution in Depth of the Marine Algae in the Caribbean and Adjacent Seas.* While many reports detail the occasional alga found at great depths, few analyze the capabilities of the species of an entire flora to grow at various levels below the surface. Records of the distribution in depth of about 200 species of the algal flora of the Caribbean and adjacent seas which grow at depths of 10 meters or more have been kept, and are now analyzed. Excluding the Myxophyceae (particularly ill adapted in this respect), the Phaeophyceae are the least successful, the Chlorophyceae very much more successful, and the Rhodophyceae in a moderate degree the most adaptable. While the Florideae of various families all share substantially in the flora of deeper waters, the successful Chlorophyceae are mostly in the Caulerpaceae and Codiaceae. Only a relatively small proportion of these 200 species have never been found growing closely below low-tide line; as for this small group later field studies may reduce this presumably obligatorily bathyphilic group still more, and show where certain shoal-water sites duplicate many features of the deeper water environment.

TAZAWA, M. *See* KAMIYA, N., *et al.*

TEIXEIRA, A. R. Instituto de Botânica de São Paulo, Brazil. *Characteristics of the Generative Hyphae of Polypores of North America.* The importance of the generative hyphae is clear if one considers that they are essential to the biological cycle of the polypores, necessary for the formation of the carpophores, and are always present in all fruit bodies. Nevertheless, many descriptions, even by well-known mycologists, ignore them. Greatest value to the presence or absence of clamp connections in the generative hyphae is given, because clamp connections are one of the most important clues to the evolutionary origin of the Basidiomycetes; they are structures much more primitive than basidia, and already existed before any ascus had evolved into a basidium. Hence, the importance of the study of these structures in one of the most advanced groups of the Basidiomycetes—the Polyporaceae—to determine which species or groups of species still show clamp connections, and therefore retain the ancestral way of reproducing the dicaryotic cells. This paper, first of a series, gives descriptions, with illustrations, of the generative hyphae of fourteen species of North American polypores: *Coriolus versicolor, Daedalea confragosa, Daedalea juniperina, Daedalea quercina, Elfvingia applanata, Fomes fomentarius, Fomes marmoratus, Fomitopsis ohiensis, Fomitopsis pinicola, Gloeophyllum abietinellum, Gloeophyllum striatum,* and *Laricifomes officinalis,* with clamp connections in the generative hyphae; and: *Inonotus cuticularis* and *Inonotus hispidus,* without clamp connections.

TEPFER, SANFORD S. University of Oregon. *The Shoot Apex and Early Leaf Development in Clematis.* The high-domed shoot apex comprises a two-layered tunica and shallow corpus. The rib meristem at times extends to within six cells of the summit. The cells of tunica and corpus are uniform cytologically, distinguishable only by the orientation of division planes. No zonation is visible within the corpus. No evidence was found of the existence of a "méristème d'attente"; mitotic figures appearing frequently in the central region of the tunica and corpus. Decussately arranged leaf primordia arise low on the flanks of the apex. Periclinal divisions in the inner tunica and outermost corpus layers mark the site of initiation. Details of the growth and early differentiation of the leaf primordium follow the usual pattern of buttress formation, growth through apical and subapical initials. Apical growth continues beyond the early stages of leaf ontogeny; the blade-forming marginal meristems not appearing until after leaflet primordia are formed. There are five primary leaflets, pinnately arranged. Each leaflet is three- to five-lobed. In primordium P_2, expansion of the adaxial-lateral margins occurs at the base, but not above. This marks the upper limits of the basal pair of lateral leaflets. In P_3, the upper limits of the upper lateral leaflets become demarcated in similar fashion.

TERASMAE, JAAN. Geological Survey of Canada. *Palynological Designation of Interglacials and Interstadial Intervals.* Recent palynological and paleobotanical studies have indicated that it is possible to describe and identify the interglacial and interstadial intervals of the Pleistocene epoch by an investigation of plant microfossils in deposits of these intervals. The palynological studies have certain advantages over other chronological methods. The small size of necessary samples, the specific identity of pollen grains and spores and their resistance to chemical treatments are some important features of palynological methods. The presence of plant microfossils in most types of sediments further increases the versatility of pollen analysis. The palynological designation of interglacial and interstadial intervals is readily made in southern Canada, but becomes gradually more difficult in the northern regions. Further studies of modern pollen types, modern pollen spectra, and air-borne pollen, coupled with ecological and phytogeographical studies, are much needed for successful palynological studies of Pleistocene and also pre-Pleistocene deposits.

TERENIN, A., and A. SIDOROV. University of Leningrad. *Infrared Spectra of Chlorophyll and Its Derivatives.* The infrared spectra of the pheophytins with different metal atoms (Zn, Cu, Ni) of pheophytin and chlorophyll as solid films and in CCl_4 solutions have been recorded. A comparison of the spectra shows that the central metal atom does affect the entire array of bonds in the molecule and its influence is transmitted to the periphery: the carbonyl groups, the cyclopentanone ring, etc. When H_2O, D_2O, or pyridine is added to a solution of chlorophyll in CCl_4, conspicuous changes in its infrared spectrum occur as well as in the vibration frequencies of the added molecules, which point to the formation of addition compounds. Since the spectra of pheophytin and the addends under similar conditions remain the same, it can be inferred that H_2O, D_2O pyridine molecules are in the other cases bound to the central metal atom. On pyridine addition, the cyclopentanone ring of chlorophyll is converted into the ketonic form for all the molecules, whereas in the solid film 20 per cent of the molecules are in the enolic form.

TEUBNER, F. G., and JANE Y. SHEN. University of Nebraska. *Modification of Floral Morphogenesis in Lycopersicon esculentum by N-m-tolylphthalamic Acid.* The monochotomous type of inflorescence in the tomato can be modified by application of N-m-tolyphthalamic acid to give dichotomous and polychotomous types. Histological studies indicate the optimum time for treatment to induce polychotomous branching is when the first or second flower primordia have begun to differentiate. Development of the sympodial bud is retarded in treated plants, apparently as a consequence of extensive meristematic activity in the apical floral meristem. Multiple primordia appear simultaneously within seven days after treatment resulting in branching of the inflorescence which is clearly apparent nine days after treatment. When N-m-tolylphthalamic acid is applied to different parts of the young seedling, dosage-response curves are obtained which indicate that the primary site of action is in the developing meristem. The use of carbon 14 labeled N-m-tolylphthalamic acid suggests that as little as 0.01 micrograms of the chemical per meristem may induce the response. The mode of action and the metabolic fate of this chemical within the plant will be discussed.

THELLIER, MICHEL. Laboratoire de Physiologie Végétale, Paris. *Pénétration et transport du bore fourni en application foliaire utilisant l'isotope stable 10 comme traceur.* Des expériences antérieures effectuées sur *Raphanus sativus* L. ont montré que du Bore absorbé par voie foliaire se transportait sans doute difficilement au reste de la plante. Pour vérifier cette hypothèse, du Bore 10 a été déposé sur les feuilles de Radis carencés (le Bore naturel étant formé, lui, en majeure partie, d'isotope 11), et sa pénétration a été suivie dans la plante. L'isotope 10 étant stable, j'ai utilisé, pour le mettre en évidence, une méthode mise au point par Mme Garin et moi-même. Elle consiste à bombarder la préparation par un flux de neutrons en présence d'une émulsion photographique. Dans ces conditions, le Bore 11 ne subit aucune modification, mais le Bore 10 donne naissance à un rayonnement α facilement repérable dans l'émulsion. De la densité des traces α observées, on peut déduire la concentration en Bore de chaque point du tissu étudié; on a constaté qu'il y avait bien une grosse accumulation de Bore 10 dans la zone de la feuille où la goutte avait été déposée, et que le reste du tissu n'en contenait que des quantités faibles ou inappréciables.

THIMANN, KENNETH V. Harvard Biological Laboratories. *Correlative Aspects of the Shoot.* The major correlations occurring in the shoot are five: (1) influence of the terminal bud on lateral bud development ("apical dominance" *sensu stricto*); (2) influence of other organs on lateral bud development; (3) influence of leaves on the transition of buds from vegetative to flowering state, or vice versa ("photoperiodism" and related phenomena); (4) influence of leaves, flowers, and fruits on their own abscission; (5) influence of various organs on differentiation of cells in the axis. All these correlations depend upon the translocation of special substances, but while (1), (2), (4), and (5) are hormonal, involving auxins as a major component, the nature of the translocated material in (3) remains unknown. Apical dominance occurs almost universally—in monocots and dicots, in some cryptogams, and in roots. Recent work on its mechanism confirms that auxin is the prime translocated factor, and the earlier view that auxin cannot reach the inhibited bud has been disproved. However, the influence of auxin is subject to extensive modification, both by environmental factors, including light duration, and by an internal factor similar to kinetin. The interrelation and balance between auxin and kinetin (or a related compound) is probably the basis for apical dominance. The participation of factors besides auxin in the other correlations will be briefly discussed.

THIMANN, KENNETH V. *See* PORTER, WILLIAM L.

THOMPSON, JOHN F. *See* BAKER, JAMES E.

THOMPSON, R. H. University of Kansas. *The Life Cycles of Cephaleuros and Stomatochroon.* Species of *Cephaleuros* grow subcuticularly or within the leaf tissue of higher plants. Sporangiophores project above the leaf surface and bear 1 to 14 or more zoosporangia. Usually only 8 quadriflagellate zoospores are produced per sporangium. Sporangiophore initials often develop into akinetes which, upon germination, may also produce quadriflagellate zoospores, 8 to 16 in number. Gametangia are sessile and dorsal on the vegetative filaments. They are variable in size and produce 8 to 32, usually 16, biflagellate isogametes. Syngamy may be extra- or intra-gametangial. In either case, the zygote germinates immediately to produce a dwarf sporophyte plant. This consists of an attaching stalk cell bearing one or more suffultory cells each with a small dehiscent microsporangium. Four quadriflagellate microzoospores are produced per sporangium. All evidence points to the occurrence of meiosis in microzoospore formation. Compared with *Cephaleuros*, *Stomatochroon* is greatly reduced in its vegetative development, the only portions visible being the sporangiophores which issue from the host stomata. The life cycle is identical to that of *Cephaleuros* with extra- or intra-gametangial syngamy and the immediate development of a minute sporophyte which may lack a stalk cell. Both *Cephaleuros* and *Stomatochroon* are isogamous, homothallic, and have a heteromorphic alternation of generations.

THOMSON, JOHN W. University of Wisconsin. *Evolution in the Lichen Genus Physcia.* Studies of the species of *Physcia* in the New World and of their distribution patterns lead to the conclusion that this is a very old group which is tropical or subtropical in origin. There are two generic centers of variation in North America: namely, the southwestern United States and adjacent Mexico, and the Appalachian region. Distribution of species characters in the genus suggests that this is a very slowly evolving group. The more primitive species characters seem to persist in the general population of the species by means of vegetative propagation. Other, comparatively more recent mutations involving specialized characters have arisen in the population of the species. These variations occupy restricted portions of the ranges of the species. The most active center of evolution in the genus in North America corresponds with the distribution of the Madro-Tertiary geoflora.

THRESH, J. M., and T. W. TINSLEY. West African Cocoa Research Institute, Ibadan, Nigeria. *Some Problems in the Classification of Cocoa Viruses.* Cocoa swollen shoot is the most important virus disease of cocoa in West Africa. Great difficulty has been experienced in assessing the relations among the large number of strains which exist and it is felt that parallels can be drawn with other plant viruses — particularly those affecting tree crops. The present state of the knowledge is reviewed with particular emphasis on techniques.

TIHONIENKO, ANNA C. *See* LECHEVALIER, HUBERT

TIKHOMIROV, B. A. Academy of Sciences, Leningrad. *Thermophyte Flora of Chukotka: Its Peculiarities and Origin.* The plants growing near the thermal springs (thermophytes) in Chukotka have different resistance to the action of high temperature and can be divided in this respect into the following groups. (1) Euthermophytes: (*a*) water plants growing at the water temperature 30-80°, this group consists of Cyanophytes: *Plectonema notatum, P. nostocorum, Phormidium tenue, P. tenuissimum, Scytonema caldarium,* and others; (*b*) terrestrial plants growing at the soil temperature 30-40°: *Agrostis scabra, Athyrium alpestre, Heleocharis kamtschatica.* (2) Mesothermophytes: (*a*) terrestrial plants growing at the soil temperature of 15-30°: *Arabis kamtschatica, Barbaraea orthoceras, Callitriche verna, Carex cryptocarpa, C. rariflora, Critesion jubatum, Deschampsia borealis, Dryopteris linnaeana, Epilobium hornemannii, E. palustre, Galium trifidum, Gentiana auriculata, Juncus arcticus, J. beringensis, J. leschenaultii, Mentha sachalinensis, Potentilla egedii, Primula asiatica, Triglochin maritima, T. palustris,* and others. At the same time all these species have very high salt-resistance (thermohalophytes). The geographical analysis of the thermophytes of Chukotka shows that they have much in common with the corresponding flora of the volcanic belt of the Pacific Ocean (Kamtchatka, Kuril Islands). The migration of the thermophytes into Chukotka probably took place before the origin of the Bering Strait. The littoral flora (halophytes) was rich in that time. Some of the species belonging to this flora penetrated along the shores of creeks up to the region of the present-day springs. The great majority of these species became extinct after the intrusion of Arctic cold water into the Bering Sea. Some of them survived near the thermal springs, having become adapted to the new environment. These species persist there to the present time.

TIMONIN, M. I. Vining C. Dunlap Laboratories, Tela Railroad Co., Honduras. *A New Species of the Genus Pseudobotrytis: P. bisbyi.* A fungus isolated from local soil was placed in the genus *Pseudobotrytis* Krzemieniewska and Badura. It differs, however, from the type species *P. terrestris* (Timonin) Subramanian in the character of spores. The new species is described and the genus *Pseudobotrytis* is discussed.

TINSLEY, T. W. *See* THRESH, J. M.

TOLBERT, N. E. Michigan State University. *N-trimethyl-2-chloroethylamine Chloride and Related Compounds as Plant Growth Regulators.* Compounds with the structure of $CH_2X–CH_2–N^+(CH_3)_3 \cdot X^-$, where X represents halides, when applied to the soil or sprayed on leaves, cause plants to grow with shortened internodes. Treated wheat has shorter internodes, thicker stems, broader and greener leaves, earlier and stronger tillering. This growth is the opposite in appearance from that caused by gibberellin. Gibberellin reverses the action of these tertiary amine halides and they can reverse the effects of gibberellin. The trimethyl group of the amine is necessary for activity. The ethyl side chain is over a hundred times more active than a methyl or propyl side chain, whose apparent activity may be caused by ethyl contamination. Normal or isobutyl derivatives are inactive. N-trimethyl-2-chloroethylamine chloride (chlorocholine chloride or CCC) is active and not toxic between 10^{-2} to 10^{-7} *M*. The bromide derivative is slightly less active and more toxic. An iodide compound was very toxic. Concentrations greater than 10^{-3} *M* CCC completely suppress internode elongation of wheat unless reversed by GA. At 10^{-3} *M* total growth of the plant is reduced. Preliminary greenhouse data indicate increased yield of grain from wheat treated with low concentrations.

TOLBERT, N. E. *See* WITTWER, S. H.

TOLLIN, GORDON. University of California. *Spectroscopic Studies of the Primary Quantum Conversion Process in Photosynthesis.* A number of physical techniques have proved to be of value in studying the primary quantum conversion process in photosynthesis. These include investigations of delayed light emission, absorption spectra changes, and light-induced electron spin resonance in intact plant materials, as well as the photoconductivity and electron spin resonance of *in vitro* pigments. The present paper will summarize some of the information obtained through such experimentation.

TOLMATCHEV, A. Académie des Sciences, Léningrad. *Sur l'origine de la flore arctique: Quand, où, et comment surgit la flore arctique?* La région floristique arctique dans le sens actuel présente une formation jeune. Au temps tertiaire la flore des bords polaires de la terre ferme septentrionale portait un caractère entièrement différent et se distinguait beaucoup moins nettement des flores des espaces situés sous les latitudes plus tempérées. L'hypothèse de Steffen sur le développement de la flore arctique au Néogène dans la région de la mer de Behring actuelle, en rapport avec le site du pôle Nord présumé par la théorie de Koeppen-Wegener, est inconsistente. Elle est en contradiction évidente avec les faits paléobotaniques et phytogéographiques. Les conditions déterminant l'existence de la flore arctique du type moderne se sont formées dans le haut nord du globe à la limite entre le Pliocène et le Pleistocène et ont atteint le développement complet dans le courant de ce dernier. C'est à cette époque que se rapporte la constitution primordiale de la flore arctique comme un complexe d'éléments. L'âge de ces derniers, dans une série de cas, est plus ancien que le temps de leur assimilation dans la composition de la flore donnée. Au début, la flore arctique se formait d'éléments autochtones (arctogènes) croissant jusqu'à la complète déforestation de l'Arctique sur les sommets et les versants des montagnes, aux endroits de stagnation prolongée de la neige, sur les plages refroidies par l'action de la mer, etc. Leur trait commun était leur adaptation

aux températures basses et à la brièveté de la saison chaude. Le domaine principal de la formation de la flore arctique fut un espace sous haute latitude s'étendant du Taimyr dans l'Ouest jusqu'au Nord du Groenland dans l'Est, embrassant une partie considérable du shelf, aujourd'hui submergée. L'espace gravitant vers la mer de Behring, n'entrait pas dans la composition de l'Arctique le plus ancien. La communication entre ses parties asiatique et américaine se trouvait au nord du détroit de Behring. L'importance déterminante pour le développement successif de la flore arctique appartenait à la répartition de ses éléments entre les confins de la région circumpolaire et l'enrichissement graduel de la composition de la flore aux dépens de l'immigration des éléments d'origine plus méridionale (principalement, alpigènes) se réalisant à maintes reprises, en partie, par différentes voies. La formation des éléments locaux contribuait aussi à l'enrichissement de la flore.

TOLMATCHEV, ALEXANDER I. Academy of Sciences, Leningrad. *Der autochtone Grundstock der arktischen Flora und ihre Beziehungen zu den Hochgebirgsfloren Nord- und Zentralasiens.* Die arktische Flora des modernen Typus entstand ursprünglich im Anfang des Quartär im hocharktischen, dem Polarbecken nächstliegenden Gebiete (nicht im Behringsmeergebiete!), teilweise durch die Ausscheidung der am meisten der Kälte angepassten Elemente der spät-neogenen Flora, teilweise durch die Neubildung extrem kryophiler Arten aus den an Ort und Stelle vorhandenen mässig-kryophilen Urformen. Der autochtone (arktogene) Grundstock (= d. eoarktische Element) der arktischen Flora umfasste Pflanzenarten, die mit den im Winter fast schneefreien Berg- und Hügelgipfeln, andererseits mit den am meisten schneereichen Lokalitäten verbunden waren. Auch einige Sumpf- oder Wiesenpflanzen, ebenso wie einige Strandhalophyten, gehörten zum eoarktischen Florenelement. Tertiäre Relikten in engerem Sinne sind in der heutigen arktischen Flora kaum erhalten. Einige der ältesten Bürger der arktischen Flora haben sich seit langem zirkumpolar verbreitet; andere sind nur den während des Pleistozän eisfrei gebliebenen Teilen der Arktis eigen. Im Laufe des Pleistozän ist die arktische Flora bedeutend bereichert worden, vorwiegend durch die Einwanderung (und mehr oder weniger weite Verbreitung innerhalb der Arktis) alpigener Elemente, insbesondre v. asiatischen Ursprung. Einige in weiterem Sinne arkto-alpine Pflanzensippen sind ihrem Ursprung nach weder arktogen noch alpigen. Sie sind infolge einer nahezu parallelen Entwicklung von arktischen und Hochgebirgs-Arten aus den mässig-nordischen heliophilen (teilweise mit steppenähnlichen Formationen verbundenen) Urtypen entstanden.

TOMIYAMA, K. University of Wisconsin. *Snow Blight of Winter Cereals in Japan.* The primary cause of winter injury to crop plants in Japan is attributed to fungi. The fungi involved, listed in order of their distribution from north to south, are: *Sclerotinia graminearum, Typhula ishikariensis, T. incarnata, Fusarium nivale,* and *Pythium* spp. The distribution of species appears to be associated with the humidity under the snow. The resistance of wheat plants to *Typhula,* according to Japanese investigations, is associated with the accumulation of ample reserves and the development and maturation of cell walls and wall thickenings in the leaves during the autumn. The mechanism of disease resistance in association with composition and structure has been investigated under different environments. Studies on life histories of the pathogens and the relation

of environments to disease development have defined control measures associated with cultivation methods and crop rotations. The most effective control is obtained by combining cultural methods with the application of fungicides, including mercury compounds.

TOMLINSON, P. B. University College of Ghana. *The Systematic Anatomy of Palms.* The subfamilies of palms already recognized by taxonomists have, on the whole, combinations of anatomical features, particularly in the lamina, by which they can be recognized. The existence of one other group (Iriartoideae) is suggested by anatomical evidence. The main anatomical subdivision of the whole family agrees with one into reduplicate- and induplicate-leaved groups rather than into fan- and feather-leaved groups. *Phoenix* and the Caryotoideae probably fall into neither of these two main categories. Anatomy suggests that the two anomalous genera *Nipa* and *Phytelephas* are not related to each other although both are rightly included in the Palmae. Within the subfamilies smaller groups of genera with similar anatomical features can sometimes be recognized. Many individual genera possess distinctive structural features by which they can be recognized. In contrast, many genera in the large tribe Arecoideae are anatomically very similar. A number of genera possess combinations of microscopic characters which suggest that their accepted systematic position is anomalous and yet they cannot be ascribed to any existing tribe. Probably each of these genera should be placed in its own subfamily. In general, from the anatomical examination of the vegetative organs of an unknown palm it should be possible to ascribe it to its correct subfamily, and in many instances to its correct genus.

TOOLE, E. H. U.S. Department of Agriculture. *Mechanisms of Dormancy in Seeds.* Dormancies are traced to blocks in the anastomosing pathways of processes leading to germination. These blocks may be associated with substrates, toxic materials, or lack of balance in metabolic changes, or they may result from the absence or the inadequate activation of an essential enzyme. Studies of the interacting effects of different environmental factors on germination processes show that the chain of preparatory changes proceeds at different rates in various kinds of seeds and that blocks can occur at different points in this chain. Dormancy of certain seeds is controlled by a reversible red, far-red photoreaction which affects one step in the pathway of germination. Blocks to germination can be imposed by high temperatures. In some seeds one of these blocks is not released by lowering the temperature but requires the action of red light. A block can be imposed on some seeds by continued excitation of both forms of the photomorphogenic pigment, and germination is then controlled by the low-energy red, far-red photoreaction.

TORREY, JOHN G. University of California. *The Initiation of Lateral Roots.* The branching pattern of the mature root system is determined by the site and frequency of initiation of lateral root primordia during ontogeny. Studies of root branching in seedlings have suggested two mechanisms controlling the site of lateral root initiation. The essentiality of certain growth substances and factors for root initiation in excised root parts has led to the view that the supply of these factors within the root, either from the root tip or from the shoot and cotyledons, determines the site of root initiation. Other evidence from studies of decapitated roots and from extractions of roots points to the activity of an endogenous inhibitor of lateral root initiation which originates in the root tip and exerts an inhibitory effect behind the tip. Evidence for these two views will be examined and discussed.

TOVMASJAN, O. V. *See* GLOUSHCHENKO, I. E.

TOWERS, G. H. N. *See* AVADHANI, P. N.; BROWN, STEWART A., *et al.*

TREBST, A. V., M. LOSADA, and D. I. ARNON. University of California. *Requirements for CO_2 Assimilation in a Reconstituted Chloroplast System.* CO_2 assimilation by isolated chloroplasts was previously shown to proceed in the dark at the expense of substrate amounts of reduced triphosphopyridine nucleotide ($TPNH_2$) and adenosine triphosphate (ATP) formed by the photochemical reactions of photosynthesis (Nature *182:* 351, 1958). In the present experiments CO_2 assimilation by illuminated chloroplasts was investigated in a "catalytic" system which, like an intact cell, required a continuous regeneration in light of catalytic amounts of ATP and $TPNH_2$. An additional requirement was the presence of a "primer" substance, one of a number of phosphorylated sugars and related compounds, to produce an acceptor for CO_2. The sites of action of ATP and $TPNH_2$ were investigated by means of inhibitors and suitable enzyme systems. When the light reaction was limited to ATP formation (cyclic photophosphorylation, Science *127:* 1026, 1958) CO_2 assimilation stopped at the level of phosphoglyceric acid. The assimilation of CO_2 to the level of carbohydrates required additional ATP as well at $TPNH_2$ (non-cyclic photophosphorylation).

TREGUBOV, V. Ljubljana, Yougoslavie. *Abieti-Fagetum.* L'*Abieti-Fagetum* est une forêt sapin-hêtre des montagnes de l'Europe centrale (France, Suisse, Italie, Allemagne, Tchécoslovaquie, Yougoslavie, Roumanie, Pologne). Beaucoup de phytosociologues ont décrit à l'aide de tableaux phytosociologiques des associations d'A.-F. de leur pays: Braun-Blanquet, Moor, Kuoch, Bartsch, Oberdorfer, Klika, Kulczynsky, Dzjubaltovsky, Domin, Horvat, Jovanovitch, Trégubov, etc. Comme toutes ces forêts se ressemblent, j'ai tâché de discerner les traits communs et ainsi contribuer à l'appréciation du rang systematique phytosociologique de ces groupements végétaux. Dans un tableau comparatif synthétique de 76 colonnes, j'ai réuni les données des tableaux phytosociologiques publiés, qui étaient chacun réduit à une colonne. Conclusions: (1)L'*Abieti-Fagetum* est un groupe d'associations (Climax) représentant un vaste étage de végétations au-dessus des hêtraies montagnardes et au-dessous des pessières dans le massif central Alpin ou des hêtraies subalpines sur les Alpes Dinariques. Appartenant incontestablement au *Fagion* dont les espèces caractéristiques sont souvent présentes, mais ne sont pas aussi nombreuses et significatives que dans les hêtraies pures, qui sont à des altitudes inférieures. L'A.-F. est un groupe d'associations personnifié possédant aussi des préférentes de *Vaccinio-Piceetalia*: *Lonicera nigra, Rosa pendulina, Aspidium spinulosum, Pirola secunda,* ce qui montre une très légère acidification du sol. L'A.-F. n'a pas d'espèces caractéristiques exclusives, mais on distingue un ensemble spécifique comprenant: *Abies alba, Sorbus aucuparia, Sambucus racemosa, Ribes alpinum, Galium rotundifolium, Prenanthes purpurea, Hieracium murorum, Senecio fuchsii, Festuca silvatica, Elymus europaeus* et parfois *Lonicera alpigena.* (2) Le groupe A.-F. est constitué d'associations géographiques, caractérisées par des endémiques. A leur tour,

elles se divisent en sous-associations, ayant des différentielles, qui reflètent les conditions écologiques locales. (3) L'*Abieti-Fagetum dinaricum* (Trégubov, 1957) se trouve au centre de l'aire de l'A.-F. région qui a été exempte de glaciers, par conséquent riche en espèces endémiques: *Aremonia agrimonioides, Cardamine trifolia, Dentaria enneaphylla, Dentaria polyphylla, Dentaria savensis, Anemone trifolia, Rhamnus carniolica, Homogyne silvestris, Omphalodes verna, Helleborus niger,* etc. Ces espèces sont des caractéristiques et des différentielles. (4) L'A.-F. occupe d'immenses surfaces, c'est une très riche forêt qui, traitée en futaie jardinée, donne un rendement élevé. Les forêts naturelles de sapin-hêtre sont en Europe unes des plus importantes du point de vue économique.

TREMAINE, J. H. *See* WILLISON, ROBERT S., *et al.*

TROUPIN, G. M. Institut pour la Recherche Scientifique en Afrique Centrale, Congo Belge. *Les Formules de végétation et la notion du dynamisme.* Diverses formules de végétation ont été proposées, notamment par Dudley L. Stamp ainsi que par C. S. Christian et R. A. Perry. Jusqu'à ce jour, ces formules ne donnent pas entière satisfaction aux écologistes et aux phytogéographes, soit parce que la part de subjectivité y est relativement importante, soit parce qu'elles sont trop complexes, leur utilisation réclamant un temps quelquefois considérable. Si la notion de complexité de la végétation a été introduite dans les formules proposées par Christian et Perry, il reste que ces formules apparaissent encore trop statiques, aucun symbole ou autre système de représentation n'exprimant le dynamisme des formations végétales étudiées. Il est apparu, lors de travaux écologiques réalisés en 1958 au Ruanda (Afrique Centrale) que le dynamisme de la végétation ne peut être négligé si l'on tient compte de l'évolution profonde et rapide affectant les divers types de végétation en l'espace de quelques années. Une nouvelle formule est proposée laquelle tient compte de la stratification, du recouvrement de chaque strate, de la composition et du dynamisme.

TRURNIT, H. J. RIAS Inc., Baltimore. *Spectroscopy of Chlorophyll Films.* The absorption spectra of chlorophyll a and b monolayers, under known thermodynamic conditions, at water-air and at water-oil interfaces, have been compared with the absorption spectra of these pigments in organic solvents and in living *Chlorella* suspensions, where the influence of scattering was accounted for. The results support the hypothesis that chlorophyll in living chloroplasts is in a monolayer state. We have also studied the film behaviour and absorption spectra of mixtures of chlorophyll a or b with β-carotene and with simple long chain aliphatic compounds.

TSCHUDY, ROBERT H., and ROBERT M. KOSANKE. Palynological Research Laboratory and Illinois State Geological Survey. *Gnetaloid and Vesiculate Permian Sporomorphs.* Vesiculate and gnetaloid Permian sporomorph elements of a Lower Permian flora from Texas are described. This flora may be characterized by three general sporomorph types: (1) a gnetaloid–*Ephedra* L. complex; (2) a striate, bisaccate "*Lueckisporites*" potonie and Klaus complex; and (3) a *Florinites* S. W. & B.–*Endosporites* Wilson and Coe–*Pityosporites* Seward complex. A series beginning with *Ephedra* and merging into *Ephedra*-like pollen possessing small primitive saccae, and terminating in the "*Lueckisporites*"-type bisaccate, striate sporomorphs is reported. Comparison is made between this

Texas Permian flora and the Permian floras reported from Australia, New Zealand, India, and Europe.

TSUBO, Y. Kobe University. *Chemotactic Behaviour of the Gametes of Chlamydomonas.* Occurrence of intraspecific chemotaxis was demonstrated in *Chlamydomonas sp. 24* (Tsubo, 1957), a heterothallic and isogamous species from Japan. The reaction is unidirectional; the "plus" gametes are attracted to the "minus" gametes or cell-free supernatant of medium in which the "minus" gametes were suspended. In a comparative study with four other isogamous, heterothallic species – *C. moewusii, C. eugametos, C. reinhardi,* and *C. sp. 50* – none of them was shown to have any intraspecific chemotactic behaviour. However, as with the "plus" gametes of *C. sp. 24,* both mating types of *C. moewusii, C. eugametos,* and *C. sp. 50* were found to be interspecifically attracted to the supernatant of the "minus" culture of *C. sp. 24.* Only *C. reinhardi* did not show any chemotactic behaviour in any combinations. Although chemotaxis occurred in the above-mentioned interspecific combinations, no agglutination, pairing, or zygote formation followed. The "minus" cells of *C. sp. 24,* which had been killed by osmium vapour and then washed, no longer produced the chemotactic agent, but they still had the ability to agglutinate with living "plus" cells. Evidently chemotaxis is a separate step from agglutination and zygote formation in *Chlamydomonas.* In preliminary studies of the chemical nature, the chemotactic agent produced by *C. sp. 24* was shown to be a volatile substance or substances.

TSUNEWAKI, KOICHIRO, and B. CHARLES JENKINS. University of Manitoba. *Monosomic and Conventional Analyses of Genes in Common Wheat.* Inheritance of growth habit, awnedness, and hairy glume in common wheat was studied by monosomic and conventional analyses in order to determine the interrelation between these methods used for gene analysis. Seven varieties of common wheat were crossed with each of the 21 monosomic lines of Chinese Spring. In addition, diallel crosses were made among all eight varieties. F_1 and F_2 generations from these crosses were studied. Results obtained by the two methods were in complete agreement with each other although the monosomic analysis provided critical information on number and location of the genes involved. The conventional analysis provided information on the gene interaction. Growth habit was found to be controlled by genes in three allelic series Sg_1, Sg_2, and Lm, located on chromosomes XVIII, IX, and XX, respectively. Awnedness is controlled by genes in seven allelic series Hd, B_1, B_2, A_1, A_7, A_8, and A_9, on chromosomes VIII, IX, X, II, I, III, and XI respectively. Hairy glume is controlled by genes in one allelic series Hg, on chromosome XIV. From the results, genotypes have been assigned to each variety, satisfactorily explaining phenotypes in the F_1 generation and segregation ratios in F_2 populations for each method.

TUCKER, JOHN M. University of California. *A Review of Hybridization in North American Oaks.* More than a hundred different interspecific oak hybrids are recorded for North America. A number of others, as yet unpublished, are known; undoubtedly others will be discovered as the Mexican and Central American species become better known. Hybridization in nature apparently is entirely within subgeneric limits although experimentally produced inter-subgeneric crosses have been reported by Pjatnitzky. Within the two larger subgenera, *Lepidobalanus* (white oaks) and *Erythrobalanus* (red or black oaks), hybridization is recorded between species of all degrees of relationship. Several examples in *Lepidobalanus* are considered, from hybrids between distantly related species to others between very closely related species. Factors limiting hybridization — genetic, ecological, and temporal barriers — are discussed. The biological results of hybridization are outlined, ranging from (*a*) production of sterile F_1's, through (*b*) introgression and increased heterozygosity of one or both species, to (*c*) the near or complete "swamping out" of a species. Taxonomic problems resulting from hybridization are discussed.

TUCKER, JOHN M. *See* CHEADLE, VERNON I.

TULECKE, W. Chas. Pfizer and Company, Inc., Brooklyn, N.Y. *Plant Tissue Cultures Derived from Three Gymnosperm Pollens.* Tissue cultures from the pollen of *Ginkgo biloba* L., *Pseudolarix amabilis* Rehd., and *Taxus* sp. are compared as to growth rate, cell types, and their growth response to specific nitrogen sources. The tissue derived from *Ginkgo* pollen (strain 5857) grows on a synthetic medium containing arginine and is the fastest growing tissue of the group. An unusual character of the *Pseudolarix* pollen tissue is its green pigmentation. The *Taxus* culture is white and is composed of cells which elongate and resemble pollen tubes in their growth; this tissue has given rise to a strain which is green and has a texture and cell type different from the parent culture. The methods used for storing the pollens, plating them out on nutrient media, and isolating and culturing tissues are also described.

TULECKE, W. *See* NICKELL, LOUIS G.; WEINSTEIN, LEONARD H., *et al.*

TURIAN, GILBERT F. Université de Genève. *Action antipigmentaire de la diphénylamine (DPA) chez les champignons et les algues.* La production du pigment mélanique noir chez les champignons *Sordaria macrospora* et *Coniella diplodiella* est fortement réduite par adjonction de DPA 10^{-5} à leur milieu de culture. Une inhibition sélective de la synthèse des caroténoïdes, avec apparition concomitante d'une substance fluorescente, a été récemment obtenue chez l'algue *Chlorella rubescens* cultivée en milieu hétérotrophique et caroténogène de Detmer additionné de DPA 1/250.000. La DPA protège le carotène d'une rapide oxydation en solution alcoolique.

TURIAN, GILBERT F. Université de Genève. *Differentiation in Blastocladiales.* Differentiation in these aquatic Phycomycetes will be reviewed at two main levels of organization: (1) at the cell level where differentiation is dominated by the chemical and structural evolution of the basophilic RNA-protein material and its organization in a peculiar cytoplasmic structure, the nuclear cap of the gamete or zoospore (correlative cytochemical, electron microscopical, and physiological studies have been conducted on this aspect of differentiation); (2) at the organ level where differentiation leads to either male and female gametangia (gametophytes) or zoosporangia and resistant sporangia (sporophytes). Of special concern will be the male gametangium of *Allomyces* with its three distinguishing attributes: carotene synthesis, high rate of nuclear multiplication, and low basophily (small nuclear caps). In its first characteristic, it may be likened to the orange sporangia of *Blastocladiella emersonii.* Its last two properties are associated with the presence of cytochemically detectable gradients for RNA synthesis in the sexual hyphae. The direction of the gradients is related to the ultimate position – epigynous or hypogynous – of the gametangia, which is genetically controlled. Genetic (hybridization, polyploidization) and chemical (thymine, etc.) factors may induce a shift of the normal 1 : 1 sex ratio in favor of male differentiation.

Turner, B. L. University of Texas. *Chromosome Lines in the Leguminosae with Phyletic Interpretations.* Chromosomal information will be related to the classical tribal lines within the Leguminosae, particularly with regard to the phyletic relationship of the Papilionoideae to the Caesalpinioideae and Mimosaceae.

Turrell, F. M., S. W. Austin, R. S. Perry, and F. A. Brooks. University of California. *Plant Responses to Artificial Winds on Cold Nights.* Fruit, leaf, twig, air, and soil temperatures have been measured inside and outside lemon trees continuously at two locations near a 90-horsepower wind machine and at two locations out of range of the wind machine blast, that is, 516 to 556 feet away. Relative humidity, inversion layer and sky temperatures, and wind speed and direction were continuously recorded during cold nights over a four-year period. Freezing during "white frosts" is prevented by mixing warm air from the inversion layer with the colder air near the ground. Frost damage from "black frosts" is reduced under the action of the wind machine because the heat capacity of the circulated air warms the sky-exposed plant parts that are normally colder than the air. Other factors causing freeze damage are water droplets remaining on fruit in the morning after a frost, and stresses resulting from rapid warming on one side of fruit by the sun. Both effects can be reduced by wind after sunrise.

Uesaka, Ichiro. *See* McClung, Norvel M.

Ullstrup, Arnold J. Purdue University. *Bacterial Stripe, an Unusual Disease of Maize.* In 1957 an unusual, and apparently thereto unreported, disease of maize was observed on certain inbred lines and their progenies under field conditions in Indiana. Progressive bleaching and striping were the most conspicuous symptoms. Upper internodes were often distorted and gnarled owing to the tight rolling of the leaves with consequent failure of the whorl to unfurl. Lower leaves on plants with these symptoms showed numerous, long, parallel-sided, greenish amber colored, translucent lesions. These were gorged with bacteria. No infection was detectable in leaves showing bleaching and striping. Lesions on the lower leaves were similar in pattern, but not in color, to those incited by *Pseudomonas andropogonis* (Erw. Smith) Stapp on *Sorghum* spp. The bacteria isolated from diseased maize were similar in morphology, cultural behavior, and physiology to isolates from several varieties of sorghum and Sudan grass infected with bacterial stripe. Isolates from maize incited typical symptoms of bacterial stripe in *Sorghum* spp.; and isolates from the latter incited symptoms in maize indistinguishable from those resulting from natural infection. Only in maize did the bleaching and striping of upper leaves occur following inoculation. Marked differences in relative resistance to the disease were found among inbred lines of maize inoculated under field conditions. From these studies it is concluded that *Ps. andropogonis* is a natural parasite of maize as well as of *Sorghum* spp.

Ulrich, Albert. University of California. *Plant Analysis in Sugar Beet Nutrition.* Plant analysis in sugar beet nutrition has progressed from a laboratory curiosity to that of a useful tool in plant nutrient surveys, field plot experimentation, evaluation of fertilizer programs, diagnosis of nutrient deficiency symptoms, and the planning of harvest schedules. The basis for this progress has been a combination of better analytical techniques and the development of the concept of critical nutrient concentrations. Plants with nutrient concentrations below the critical level have been found through many observations to be deficient in nutrients and those above, non-deficient. By taking a series of plant samples during the growing season regularly each year, a nutrient deficiency can be detected as soon as or even before it occurs and corrective measures applied before serious crop losses have taken place.

ULRICH, R. Faculté des Sciences, Paris, et Station du Froid de Bellevue (CNRS). *Température et maturation des poires nécessitant un traitement préalable par le froid.* Les conditions thermiques de la maturation seront rapidement rappelées à l'aide d'exemples (poires, pommes). On remarque que la gamme de températures compatible avec la maturation diffère selon la variété; elle est très étroite chez la variété de poire Passe Crassane qui ne mûrit complètement qu'après avoir subi un traitement frigorifique (fruits de la région parisienne). A +4° la maturation est normale et complète. A 0° elle n'a pas lieu; à +18° elle est incomplète, sauf après un séjour au froid. Les modalités de ce traitement au froid sont étudiées. Les variations de l'intensité respiratoire en fonction du temps et de la température sont décrites en liaison avec la maturation, ainsi que les variations des glucides. L'émission d'éthylène est toujours très faible. Chaque fois que les conditions thermiques sont compatibles avec une maturation complète et normale, on observe une crise climactérique, un maximum de teneur en saccharose à la maturité et une résorption complète de l'amidon.

URITANI, IKUZO. Nagoya University, Japan. *Biochemistry of Root Degeneration.* Biochemical aspects of root degeneration are illustrated by sweet potato roots infected by various pathogens in the field or in storage. In the healthy tissues adjacent to the infected ones, respiratory increase, coumarin and polyphenol production, and a change in nitrogen and phosphate metabolism were seen; in the infected tissue, ipomeamaron formation and a brown reaction appeared. In the susceptible varieties, the pathogens continued to penetrate into the tissues, yet the brown reaction was not observed; the metabolic changes spread in inner tissues, where ipomeamaron was also formed and may act as a vivotoxin at this stage; thus lignification and suberization were not caused. Such degeneration was observed in the roots treated with toxic chemicals as $HgCl_2$. *Ceratocystis fimbriata* produces ipomeamaron-formation inducers. In Dr. Stahmann's Laboratory it was found that the pathogen produced cellulase and two pectinases. Degeneration was influenced by factors such as temperature and O_2 pressure. This can be explained by the relationship between the metabolic change in the host and growth of the pathogen. Storage in cold predisposes the roots to infection by *Rhizopus stolonifer*, owing to the decrease in protoplasmic function. The metabolic degeneration in root diseases of several plants and the pathogenic factors of the pathogens are surveyed.

VAARTAJA, OLLI. Canada Department of Agriculture. *Photoperiodic Ecotypes in Trees.* Most trees respond to increasing photoperiods with increased seasonal duration and rate of growth, and increased susceptibility to cold. The responses are abrupt at a critical, short photoperiod, and gradual at and beyond an optimum. The critical and optimal photoperiods are characteristic for each population; they appear to be longer for northern than southern trees, for continental than maritime trees, and for mountain than lowland trees. This rule holds generally in intergenetic and intragenetic comparisons with many populations, and in each test with latitudinally distant sources in each of 17 species (in *Acer, Betula, Fraxinus, Larix, Picea, Pinus, Populus, Pseudotsuga, Ulmus*). These results indicate that tree species contain photoperiodically different biotypes which form distinctly different populations (photoperiodic ecotypes). Knowledge of photoperiodic ecotypes explains empirical rules of forestry and horticulture, and facilitates understanding of seasonal development in trees. Photoperiodic responses handicap trees when other factors are optimal. This suggests that selective effects of the responses have operated, during evolution, through indirect adaptation to other seasonal factors. Photoperiodically actuated adaptation mechanism increases fitness because it can function before drought, early frost, or winter cold begins. Such seasonal changes often are sudden and could kill unprepared populations of immature trees.

VALENTINE, D. H. University of Durham, England. *Introduction to the Symposium on Biosystematics.* Biosystematics is concerned with evolutionary processes in plants and their bearing on systematics. Doubts have been expressed on both sides of the Atlantic as to the validity or necessity of this discipline. Taxonomists, while not averse to using data obtained in evolutionary studies, are loth to modify their traditional ways of thought; on the other hand evolutionists, while quite prepared to use systematic data when it suits them to do so, disagree with the taxonomic concept of the species, and prefer to define it in a way which is theoretically satisfactory but which is of no practical use. The contributions to this symposium will illustrate the ways in which the two points of view can be reconciled. Thus, it is possible to discuss modes of speciation (for example, abrupt and gradual speciation) or breeding mechanisms (for example, outbreeding, apomixis), and to show that such discussions have an important bearing not only on taxonomy itself, but also on ecological and phytogeographical problems for which accurate systematic knowledge forms the indispensable basis. If time allows, two problems, which illustrate the scope of biosystematics, will be discussed. The first is concerned with the possibility of wide hybridization and its potential taxonomic value; the second is concerned with the nature of the morphological differences between species, and the extent to which they may be regarded as adaptive.

VALENTINE, D. H. *See* HEYWOOD, V. H.

VANBREUSEGHEM, R. Antwerp, Belgium. *The Dermatophytes as Saprophytes.* The author indicates the techniques which have been used to isolate pathogenic fungi from the soil: direct plating or inoculation to the animal. The isolation of a pathogenic fungus from the soil does not mean that the fungus actually lives in the soil, but only that it is in the soil in a living state. On the subject of the dermatophytes which are the cause of contagious ringworms, the author's conclusions, based on some of his experiments, are summarized as follows: (1) dermatophytes grow very well on sterile soil; (2) they remain in a living state and very young on this medium for a very long time; (3) on this culture medium pleomorphism does not develop and pleomorphic colonies may be transformed into normal colonies; (4) the colonies grown on soil, either from other colonies or as primary culture from infected hair, nails, or scales, may be inoculated into man or animal. From these facts the hypothesis has been proposed that dermatophytes live part of their lives in the soil and that such a "reserve" of dermatophytes could explain the relation between one epidemic and the next. To give a sound basis for this hypothesis, a biological technique for the isolation of the dermatophytes from the soil, based on the power of the dermatophytes to attack keratin, is suggested. By the use of this method or some other, three dermatophytes have been isolated from the soil so far: *Keratinomyces ajelloi*, *Microsporum gypseum*, and *Trichophyton* (*Ctenomyces*) *mentagrophytes*. Why have other dermatophytes not been isolated? The author suggests that either (1) the method proposed does not work for every dermatophyte, or (2) other dermatophytes are actually not present in the soil. If the latter is true, we would have to admit that they are destroyed in the soil. Nevertheless, the author believes that this theory has some value and that it can explain cases of post-traumatic dermatophytia and geographical variations in the distribution of the dermatophytes. More work will have to be done. An approach is made to the problem of the true pathogenesis of dermatophytia. Cases of ringworm or tinea capitis depend on the presence of both a dermatophyte and a sensitive man or animal. The recent experience of the author in Africa indicates that protein deficiency seems to play an important role in this respect. It is concluded that the soil is a reservoir for the fungi which cause systemic mycoses; it is also a reservoir for some dermatophytes but there is still much to do to prove that other dermatophytes live or do not live in the soil.

VAN CAMPO, MADELEINE. Muséum d'Histoire Naturelle, Paris. *Analyses polliniques dans le sud Tunisien.* De nombreuses analyses de dépots d'Afrique du Nord ont été faites au laboratoire de Palynologie du Muséum, une seule a été publiée (El Guettar, Tunisie) parce que huit spectres successifs ont pu être établis sur des sédiments déposés *in situ* (autour d'un puit artésien). Les remarques suivantes concernant des études de sédiments, en grande partie tunisiens, ont pour but d'attirer l'attention des utilisateurs des méthodes d'analyse pollinique sur quelques points particuliers. Parmi les Conifères les grains de pollen de sapin ont été trouvés en petit nombre; le cèdre nous semble offrir un intérêt tout particulier, d'abord par les comparaisons possibles avec son aire actuelle relativement réduite, ensuite par sa très bonne conservation dans les sédiments; cependant, parfois, la possibilité d'un transport à longue distance ne doit pas être exclue. Le pollen de pin d'Apep ne donnera de résultats satisfaisants que si un grand nombre de grains peuvent être comptés dans les sédiments; sa facilité de transport alliée à la vitesse du vent, soufflant souvent en tempête dans certaines régions, et à son transport par des Oueds soudain gonflés doit rendre très prudent pour l'interprétation des résultats; en effet, nous avons des spectres polliniques avec pollen de Cupressacées sans pollen de pin, avec Cupressacées et pin, ce qui est normal, mais nous avons également des spectres avec pollen de pin sans un seul grain de pollen de Cupressacées, ces derniers spectres ne doivent pas à notre avis être pris en considération, l'absence totale de Cupressacées dans les Pinèdes étant rare si l'on considère des étendues assez vastes; nous admettons dans ce cas qu'il y a transport lointain. Les grains de pollen de chênes doivent être examinés avec grand soin; il est possible de distinguer *Quercus ilex*, *Q. suber*, *Q. afares*, par contre sur du matériel fossile *Quercus suber* et *mirbeckii* peuvent être confondus de même que *Quercus ilex* et *coccifera.* Les Oléacées fournissent du pollen dans l'atmosphère en quantité souvent appréciable, il y a donc grand

intérêt à les distinguer, ce n'est pas toujours chose très facile sur du matériel fossile, cependant le genre *Fraxinus* peut se différencier du genre *Phillyrea* qui peut lui-même se distinguer de *Olea*, le genre *Jasminum* se distinguant très facilement des autres. (Il parait utile d'ajouter que les grains de pollen d'*Olea europaea* L. et d'*Olea silvestris* Mill. (*O. europaea* var. *oleaster* DC.) peuvent se distinguer par les méthodes statistiques appliquées à la taille du grain et à la dimension des mailles du réticul). Les grains de pollen d'*Ulmus, Alnus, Carpinus* ou *Ostrya, Tilia* . . . n'offrent pas, quant au genre, de grandes difficultés de détermination, mais là encore la prudence s'impose pour l'interprétation des spectres si un seul grain de pollen est trouvé. Nous rencontrons naturellement (et il est intéressant de comparer ces flores de climat aride en ce qui concerne les genres représentés, aux flores du finiglaciaire européen) *Ephedra, Artemisia, Helianthemum, Plantago, Graminées, Plumbaginacées* . . . en y ajoutant ici *Nitraria Zizyphus, Tamarix, Pistacia*. . . . De nombreux grains de pollen ne sont déterminés que jusqu'à la famille ils n'ont alors d'intérêt que par leur nombre, par exemple un niveau donné 1357 grains de pollen de Chénopodiacées sur un total de 1738 grains de pollen-Akarit-un autre niveau près des Chotts Tunisiens a donné 892 Chenopodiacées et 894 Graminées sur 2065 grains de pollens, un autre niveau 482 Cypéracées, *in situ*, et 456 Chenopodiacées, apport atmosphérique, sur un total de 1158 grains de pollen. La grande variété des grains de pollen de Chénopodiacées trouvé dans ces sédiments est telle qu'il me parait difficile de distinguer les cas où elles sont halophiles ou uniquement xerophiles. Les grains de pollen d'ombellifères se rencontrent régulièrement quoiqu'en petite quantité et il est presque toujours possible de les déterminer jusqu'au genre parfois jusqu'à l'espèce. La présence d'*Erica scoparia* 6 grains et de *Thymelea* cf. *nitida* 29 grains à la latitude des Chotts permettront vraisemblablement des interprétations climatiques intéressantes.

VAN CAMPO, MADELEINE. Muséum National d'Histoire Naturelle, Paris. *Importance des caractères de l'endexine des grains de pollen en systématique et en phylogénie.* Il y a presque dix ans, lors du Congrès de Stockholm, j'avais eu la chance de pouvoir présenter une note sur la phylogénie des Conifères d'après leurs grains de pollen. Des études menées dans mon laboratoire sur quelques familles d'angiospermes semblent conduire aux conclusions suivantes. (1) Des comparaisons faites sur l'aspect général des grains de pollen, et notamment sur les caractères de l'ectexine, peuvent mener à des erreurs d'interprétation. (2) L'ectexine et l'endexine doivent être étudiées à part, il semble que les caractères de l'endexine aient été sous-estimés au profit de ceux de l'ectexine. Cependant les caractères de l'ectexine sont souvent adaptatifs (ballonets des Conifèrales d'après Doyle; épines des grains de pollen des Composées d'après Wodehouse; crêtes des grains de pollen de *Trapa natans*; gros réticule des Hippocrateaceae; ectexine épaisse des nombreux grains de pollen d'espèces de zone aride, etc.). Les caractères de l'ectoaperture (aperture dans l'ectexine) sont variables alors que ceux de l'endoaperture (aperture dans l'endexine) sont variables alors que ceux de l'endoaperture (aperture dans l'endexine) sont constants. (Chez des grains de pollen d'Ombellifères: *Cachrys laevigata* et *C. alpina, Myrrhis odorata*, on assiste à des variations de l'ectoaperture, allant jusqu'à sa disparition complète, tandis que l'endoaperture reste remarquablement constante). Les formes polliniques, c'est-à-dire d'abord les formes de l'endexine, sont importantes en systématique (dans une même famille les grains de pollen légèrement

allongés ou légèrement applatis caractérisent des groupes différents, permettant d'intéressantes corrélations, Hippocratecaceae (M. Van Campo et N. Hallé). Dans les représentations des grains de pollen (schémas et photographies), il est très important de bien faire ressortir les caractères de l'endexine, notamment dans les schémas de l'endoaperture de face et de profil. Il paraît important d'attirer très rapidement l'attention, au sein d'un Congrès de Botanique, sur ces questions. Le nombre de beaucoup le plus grand d'études polliniques se fait dans des laboratoires de recherches appliquées où les notions de variations et d'évolution sont rarement prises en considération.

VAN DEN HONERT, T. H. Leiden, Netherlands. *Methods of Measuring Suction Tension in Plants, Their Reliability and Merits.* The suction tension in plants, although a factor greatly varying with the temporary environmental conditions, is certainly the main factor governing the water economy of plants. The methods of its determination still center around those devised by Ursprung and Blum in 1916 and following years. The severe criticisms which appeared against several of their methods around 1932 have not yet been sufficiently met, so that in many cases, for example, the values obtained are suspected to be much too high (submerged plants). However, it will have to be discussed whether several other methods devised ("Schlieren Methode," refractometric method and others) are more dependable and whether they are too intricate and cumbersome to have a practical value. Very high suction tensions found in desert plants by vapour-tension measurements and ascribed to negative turgor pressures deserve attention.

VAN DEN HONERT, T. H. Leiden, Netherlands. *On the Influence of Diffusion Phenomena in Active Uptake.* If an ion is taken up by means of one carrier only, the relation between rate of intake and concentration is supposed to be represented by a Michaelis-Menten curve. Deviations from such a curve are generally ascribed to the presence of more than one carrier. A comparative study of ammonium uptake in maize roots and potato tissue discs led to an alternative explanation of such divergent curves. The ammonium uptake in maize roots seems to be practically dependent only on a carrier system, which is in direct equilibrium with the medium. In the potato discs, however, this applies only to a part of the cells; other cells seem to be separated from the medium by an internal diffusion resistance, probably having to do with the Donnan free space. The diffusion of ammonium seems to be progressively sensitive to monovalent, divalent and trivalent cations respectively. The seeming contradiction of this concept with the ready accessibility to diffusion of the free space will be discussed.

VAN DER PIJL, L. Rijksherbarium, Leyden, Netherlands. *Ecological Evolution of Flowers from Early Beetle Flowers.* The angiospermous flower must have differentiated in contact with beetles. Persisting traces are found in primitive groups still extant. The attraction may have been: (*a*) pollen; (*b*) food-tissues fit for semi-destructive visitors; and (*c*) deceiving smells of trap flowers. Myophilous flowers came next. Their syndrome of characters, already found in some fungi and mosses, developed anew in higher groups. The further adaptive radiation in the families should be considered in relation to higher pollinators and their sense physiology. A one-sided morphological approach to the study of flowers (Troll, Werth, Good), or a physiological approach (Nelsson), seems inadequate. The ecological classes of Delpino remain important as foci of directed change. Morphologists and taxonomists in neglecting them might miss the selective significance, direction of change, interrelation of characters, and presence of convergences. Flagelliflory and cauliflory may be seen as chiropterophilous characters. The anemophily of the Amentiferae seems to be a reduction from tropical entomophily. Tropical carpenter bees have been a selective factor leading to flowers with ant-guards. The primitiveness of the Polycarpicae is confirmed by floral biology.

VAN FLEET, D. S. University of Toronto. *Analysis of Patterns of Differentiation: Enzyme Localization.* Differentiation has its origin in numerous inherent energy relationships. A working hypothesis and discipline for the analysis of differentiation may be obtained from the following axioms. (*a*) Morphological development is the visible result of control attained at the earliest phases of differentiation. (*b*) Controlled and patterned cell division is a part of differentiation and the causal factors in differentiation determine the plane and rate of cell division. (*c*) Causal factors carried in the nucleus are operational in relation to the position of the cell. (*d*) Distribution of the coded information of causal factors is carried out in part by microsomes and mitochondria from the nucleus to functional positions within the cell. (*e*) Activation of enzymes catalyzing differentiation is determined by the oxidation-reduction potential and capacity associated with the position effect of the cell. (*f*) Oxidation-reduction and phosphate energy transfer reactions are determined by polar and particulate surfaces within the cell and by the over-all position of the cell in the organism. (*g*) Enzymes activated prior to or accompanying cell division are detectable in the earliest phases of differentiation and a sequence of enzyme activation reveals the steps in tissue differentiation and the origin of primordial patterns.

VAN HOOF, H. A. Institute for Phytopathological Research, Wageningen, Netherlands. *Where Do Virus and Aphid Meet inside the Plant?* The distribution of viruses in plant tissues is briefly reviewed. The path of the stilets inside the plant is examined, and times required for piercing epidermis and cell wall are analyzed. During the short periods in which aphids pick up non-persistent viruses, their stilets cannot have been inserted further into the epidermis than half-way in the transverse cell wall. So non-persistent viruses must be picked up from this cell wall. Probably direct contact between cell wall and stilet is a *conditio sine qua non* for transmission. Only here the stilet tips are not enveloped by the salivary sheath and a mechanical uptake of non-persistent virus behind the ridges on the stilet tips is possible. Persistent viruses are transmitted in a different way. Sukhov's theory that the salivary sheath works as a filter is very unlikely. More probably a direct connection occurs between the phloem sap and the food canal. The healthy test plant becomes infected outside the phloem vessel because into the phloem vessel itself no saliva is secreted. The salivary sheath ends in the wall of the phloem vessel; so infection occurs either in the wall of the phloem vessel or shortly before it is reached.

VAN ROYEN, P. Rijksherbarium, Leiden, Netherlands. *The Floristic Subdivision of New Guinea.* The main subdivision of the flora of New Guinea is indicated by the climatic difference between a northern, evergreen vegetation and a southern, monsoon area. Whereas in the former the climax vegetation is a rain forest, in the latter the vegetation is more open, with extensive savannahs and scattered trees or woods. This area is treated as a separate subdivision, the Wassi Kussa subprovince. In the evergreen area the lowland rain forest is the main feature, but mangroves and swamp forests are often found. Moreover, the midmountain, mountain, subalpine, and alpine vegetations contribute to this area. Based on these differences seven more subprovinces can be distinguished, the most extensive being the Mamberamo-Sepik subprovince along the northern coast, dominated by swamps and swamp forests. The southern counterpart is the Digoel-Fly subprovince, mainly covered by swamps, swamp forests, or lowland rain forests. Economically important is the Central Range subprovince dominated in many parts by Quercus, Nothofagus or conifer forests, while the higher parts carry a subalpine and alpine vegetation. Four more subprovinces can be distinguished, but two, the Huon and the Schouten Islands subprovince, are still dubious. The other two, the Bomberai and the Arfak-Tamrau subprovinces, are respectively characterized by Melaleuca forests in many parts and by Intsia-Araucaria forests.

VAN SLOGTEREN, DIRK H. M. Laboratory for Flowerbulb Research, Netherlands. *Diagnosis in Relation to Control of Virus Diseases of Plants.* Diagnosis is of primary importance in controlling virus diseases. Indeed, it is only on the basis of accurate diagnosis that one can assess the desirability of undertaking control measures and decide which of these are likely to prove effective. In recent years many routine diagnostic techniques have been developed from fundamental identification methods. Thus, more efficient inoculation procedures and suitable local-lesion hosts have been discovered. Serological diagnosis by precipitation and agglutination as well as gel-diffusion methods has been put into practice by devising micro-scale techniques. Modified procedures of virus purification and of immunization facilitate the production of antisera. Rapid observation by electron-microscopy is possible by the dip-method of preparation. Histochemical reactions have filled gaps where other approaches failed. The importance of soil-borne viruses requires that soil samples as well as plants be tested. Further progress can be achieved by co-operation. Diagnostic methods and equipment must be made accessible to organisations supervising plant breeding and certification. Advisory help to growers carrying out selection should be implemented by a system of inspection. Distribution on a co-operative basis of certified stocks, maintained virus-free in isolation, must be planned for crops susceptible to infection from the environment. Internationally, diagnostic approaches will benefit from an exchange of antisera and by the establishment of an international type-collection of plant viruses.

VAN STEENIS, C. G. G. J. Oegstgeest, Holland. *Axioms and Criteria for Tropical Vegetatiology.* This is an attempt to group together the axioms and criteria for gaining evidence which are used in the study and interpretation of vegetation, here called "vegetatiology" (in German: "Vegetationskunde"). None of these is new, but I have not found them listed together. Climax is defined here as primary vegetation. The axioms are: (1) From the littoral to the timberline the climax is mixed forest, except for local physiographic disturbances. (2) Sharp distinction of cause and condition is necessary in evaluating correlations. (3) Wide local experience is needed for sound judgment. (4) Students of vegetation must learn to think in long-term periods. (5) Intimate knowledge of the autecology (especially regeneration) of dominants and co-dominants is essential. (6) Chance factor of dispersal and regeneration must be taken into account. Criteria which should be used are: (1) age-class; (2) local history of area; (3) floristic composition; (4) comparison with most complex vegetation type under comparable conditions; (5) one-dominant types (these deserve special care and attention); (6) absence of forest, to be accounted for by some environmental factor(s); (7) abrupt vegetation demarcations, if not due to soil, to be regarded with suspicion.

VANTERPOOL, T. C. University of Saskatchewan. *The Albugo-Peronospora Complex on Rape. Albugo cruciferarum* S.F. Gray is the chief cause of the hypertrophies on the inflorescences of rape (*Brassica napus* L. var. *annua* Kock) in Saskatchewan. Affected tissue is packed with the brown, warty, and sinuous-ridged oospores of this fungus, but only occasionally is the white-rust conidial stage found on the enlargements. *Peronospora parasitica* (Pers. ex Fr.) Tul. oospores have never been found either alone or associated with those of *A. cruciferarum*. Frequently, however, the conidial stage of *P. parasitica* is found on the surface of hypertrophied tissue containing oospores of *A. cruciferarum* only. In addition to the well-known sessile vesicular zoosporangial type of oospore germination in *A. cruciferarum*, as described by De Bary, a second type has been found. In this, the vesicular zoosporangium is produced at the end of an exit tube one to one and a half-times the length of the diameter of the oospore, and about one-quarter of its width.

VARGA, MAGDALENE. University of Szeged, Hungary. *Examination of Naturally Occurring Phenolic Acids as Inhibitors and Their Relation to the Effect of Auxins.* The effect and the chemical character of the naturally occurring water- and ether-extractable, acidic inhibitors were studied in various parts of plants with different systematic positions. The inhibitors extracted were separated by paper chromatography and identified on the basis of the absolute and relative R_f values, the fluorescence, the spraying reactions and the ultraviolet absorption spectra. The inhibitors identified, in every case, proved to be compounds belonging to the group of the phenolic acids; the most active of them are the various cinnamic acid and benzoic acid derivatives. These compounds occur in the different test subjects in various combinations and quantitative proportions but are not specific. On the basis of the experimental data and of those available in the literature, the spread of the phenolic acids as growth-inhibiting substances in higher plants may be considered general. Under natural circumstances these compounds exert their effect in parallel and the result can be observed in the extracts. From a study of the common effect of their mixtures, it could be stated that the inhibitors predominant are auxin-antagonists. Consequently, the strong inhibiting activity of the extracts cannot be stopped by adding more auxin or by intake of -SH compounds. Accordingly, they are not acting by directly influencing the auxin effect but by blocking some other processes of the metabolism. Examination of the mechanism of action of the natural mixtures of phenolic acids and the most effective components, of their effect on the water-uptake, permeability, IAA-oxidase, respiration ferments, etc. are under way. Quantitative changes in the naturally occurring phenolic acids are related to the age of the plants and the plant organs, respectively. However, no definite correlation could be found between the content of the inhibitors and that of the auxins.

Vasilieva, N. A. *See* Sissakian, N. M.

Vatter, A. E., and J. B. Hanson. Abbott Laboratories, Chicago, Illinois, and University of Illinois. *The Effect of Ethylene Diamine Tetra-acetic Acid (EDTA) on the Cytoplasm of Plant Roots.* Soybean and corn roots treated with EDTA exhibit reduced respiration and ion absorption, particularly in the zone of elongation. This phenomenon appears to be due to degradation of ribonucleic acid (RNA) by endogenous enzymes; removal of divalent ions makes the RNA susceptible to enzymatic attack. Cytological observations by means of electron microscopy show alteration of microsomal and nuclear granules in the meristematic zone. In the expanding and mature zones, the membranes, including those of the mitochondria, show pitted and thin regions.

Vélez, Ismael. Universidad Inter Americana, San Germán, Puerto Rico. *The Role of Botanical Gardens in a Young, Rapidly Growing Metropolitan Area.* Kodachromes of the picturesque forest reserve areas, mountain parks, arboreta, and botanical gardens of Puerto Rico will be shown and explained. Plans for the expansion of the botanical gardens of the Agricultural Experiment Station and the establishment of the newly created Metropolitan Gardens of the Commonwealth of Puerto Rico will be discussed. The role of these in a rapidly growing, heavily industrialized area will be emphasized.

Vermeulen, P. Amsterdam Municipal University. *The Rostellum of Ophrydeae and Neottieae in the Orchidaceae.* In every textbook of botany the hypothesis is accepted that in the Monandrae of the Orchidaceae the central stigma-lobe has disappeared, the rostellum taking the place of this lobe. This hypothesis, prudently framed by Robert Brown, was consistently worked out by Charles Darwin and Eichler. The rostellum is the part of the column which forms sticking fluid or one or two viscid discs, with the help of which the pollinia are fastened to a visiting insect. If the central stigma-lobe changed into the rostellum only two stigma-lobes should be present. In several genera, however, there are three: for example, *Dactylorchis, Disa, Platanthera, Epipactis.* In these genera it is impossible that the median stigma-lobe should be homologous with the rostellum. The latter must be a new organ, characteristic of the Monandrae. Other genera have two stigma-lobes: *Habenaria, Gymnadenia.* There is a remarkable difference between the rostellum of the Ophrydeae and those of the other Monandrae. The Ophrydeae possess two viscid discs, whereas the other Monandrae only have one. A study of the rostellum of *Epipactis gigantea* and of *Platanthera bifolia* made it clear that the hypothesis of Brown cannot stand for the Ophrydeae. A new hypothesis is given for this family.

Vickery, Robert K., Jr., and D. W. Lindsay. University of Utah. *Crossing Barriers in Mimulus guttatus in Relation to Recent Geologic Changes in the Great Basin.* The recent geologic history of the Great Basin region of the Western United States provides unique opportunities for the experimental study of evolution. Some 12,000 to 24,000 years ago large areas of the Basin were flooded by ancient Lakes Bonneville and Lahontan. Synchronously, glaciers covered portions of the adjacent mountains. Populations of *Mimulus guttatus* DC. from formerly flooded or glaciated areas frequently contain crossing barriers, whereas populations from geologically undisturbed areas rarely do so. For example, the combinations of seven California populations from undisturbed areas averaged 79 seeds per capsule whereas combinations of these populations with one from the Lahontan lake bed and with three from glaciated regions of the Sierra Nevada set normal numbers and 36 per cent fewer seeds, respectively. The combinations of eight Utah and Idaho populations from undisturbed areas averaged 37 seeds per capsule. Combinations of these populations with two from the Bonneville lake bed, two from high elevation and one from low elevation glaciated canyons of the Wasatch Mountains averaged, respectively, only 11, 5, and a normal 32 seeds per capsule. Apparently, there is a marked tendency for populations of *M. guttatus* that have migrated in recent geologic time to evolve crossing barriers, whereas those that probably have not migrated show few such barriers.

VIGLIERCHIO, DAVID R. University of California. *Susceptibility of Cross-grafts of Beta Species to Heterodera schachtii.* In a preliminary step toward a general understanding of the nature of resistance of plants to nematode parasites, one can utilize the technique of reciprocal cross-grafting between susceptible and resistant plants to define possible expressions of such character. For practical considerations the system comprising resistant and susceptible species of the genus *Beta* and the sugar beet nematode *Heterodera schachtii* was selected. Resultant counts of the numbers of nematodes developing on the respective grafted and ungrafted root systems indicated that the rootstocks remained true, that is, responded as the parent plants irrespective of tops. One must then conclude that in this system expression of resistance or susceptibility is inherent in the roots and that no translocation of active factor from stems or leaves is involved.

VILLEGAS, LEOPOLDO. Instituto Venezolano de Investigaciones Científicas, Caracas. *Uptake and Translocation of Iron-59 in Black Bean Plants.* Seeds were germinated in simple sand, then transplanted after 8 days to a pH 4.0 nutrient solution containing iron as citrate. Uptake was studied 12 days later, adding tracer to the solution. Samples were taken after 5, 15, 30, and 60 minutes, every hour up to 6 hours and every 3 hours up to 24 hours. The uptake curve showed two phases. The first with a 0.40 hour half-time, was identified as a passive exchange process. The slow phase was identified as a soil-plant unidirectional flux; the calculated absorption constant was $0.15\text{h}^{-1} \pm 0.02$. In a group of similar plants, the weight-increase constant was $5.2 \times 10^{-3}\ \text{h}^{-1} \pm 0.7 \times 10^{-3}$. Comparison of constants ($k_a/k_{wi} = 29$) suggests active iron accumulation during studied period of the growing stage. Translocation of Fe^{59} absorbed in the 6-hour period was studied by determining its percentage distribution in all parts of the plant after 6, 12, 72, and 96 hours. Continuous mobility was observed within, with no flux in the plant soil direction. Values obtained after 96 hours as compared to those obtained after 6 hours were 7.3 and 8.6 times lower in the first and second leaves and 1.1 and 13.7 times higher in the root and stem apex with no appreciable change in the stem.

VILMORIN, ROGER DE. Verrières-le-Buisson, France. *Darwinisme et un siècle d'amélioration végétale.*

VINCE, DAPHNE. *See* SALE, P. J. M.

VIRTANEN, A. I. Biochemical Institute, Helsinki. *On the N_2-fixing Machinery in Leguminous Root Nodules and the Uptake of Fixed Nitrogen from the Nodules by Leguminous Plants.* N_2-fixation occurring in leguminous root nodules differs essentially from that in free-living micro-organisms. Rhizobia turned into bacteroids and leghemoglobin present in the cytoplasm of root cells filled with bacteroids are characteristics for effective nodules. N_2-fixation probably occurs on the surface of bacteroids, from which nitrogen compounds formed in fixation are excreted and pass into the host plant without being used in protein synthesis in the nodular bacteroid mass. Microscopic and chemical investigations give no support to the concept that plants during vigorous growth obtain nitrogen fixed in nodules through decomposition of the bacteroid mass. Symbiotic N_2-fixation is thus not connected with the proliferation of microbial cells as is the case with free-living N_2-fixers. This makes it understandable that the N_2 fixed per gm. nodule greatly exceeds that fixed per gm. free-living N_2-fixers (on fresh and dry weight basis). Under suitable conditions, still insufficiently known, excretion leads to accumulation of N-compounds outside the nodules in the medium. Since leghemoglobin is indispensable for N_2-fixation in root nodules, the concentration and stability of this hemoprotein in nodules are decisive. The oxidation rate of leghemoglobin into green pigment, legcholeglobin, depends on many insufficiently known factors. Rhizobial strains are important, very effective nodules remaining red longer than less effective ones. Growth conditions (light, temperature, etc.) also influence the stability of the pigment in nodules.

VISHNIAC, WOLF. Yale University. *Participation of Chlorophyll in Photosynthetic Hydrogen Transport.* The illumination of chloroplast fragments in tritiated water results in the incorporation of tritium in chlorophyll. This incorporation is dependent on light and is sensitive to heat. Purified radioactive chlorophyll *a* obtained from such a reaction mixture loses its radioactivity in basic solvents but retains it under acid conditions. These observations suggest that the tritium is located on C_{10}. Little or no radioactivity can be detected in chlorophyll *b*, but appreciable amounts are found in several carotenoid fractions and in some unidentified pigments. The extent of tritium incorporation in the chlorophyll *a* of chloroplast fragments is only 0.5 to 5.0 per cent of equilibration. However, an acetone powder of chloroplast fragments, which contains some chlorophyll *a* which cannot be extracted with acetone unless the proteins are denatured, will upon illumination incorporate tritium to the extent of up to 80 per cent of equilibration. These observations suggest that a small fraction of the total chlorophyll *a* in leaves is tightly bound and highly active. Purified chlorophyll *a*, labeled at C_{10} by incubation in a mildly basic solvent in the presence of tritiated water, can be detritiated by the acetone powder in a heat-sensitive and light-dependent reaction. Some tritium can be transferred from chemically labeled chlorophyll *a* to triphosphopyridine nucleotide (TPN). The possible significance of these findings for photosynthetic hydrogen transport will be discussed.

VLASJUK, P. A. Ukrainian Academy of Agricultural Sciences, Kiev. *The Importance of Mn and Its Utilization in Ukrainian Agriculture.* Based on agrophysiological researches and industrial tests in different zones of the Ukraine, it was ascertained that Mn was localized in protein compounds and accelerated the processes of binding ammonia to the carbon acceptors (ketoglutaric acid, malic, citric, and other organic acids), considerably increased the intensity of photosynthesis, and increased the crop and productivity of agricultural plants. With the help of labeled atoms, the relation of Mn to P and S was shown. With nitrate nutrition the rate of P metabolism of phospholipids and nucleic acids was considerably increased, but the rate of S metabolism of organic and non-hydrolysed forms was decreased. Micro-organisms favoured the transformation of the surplus of the soluble form of Mn in the soils into a non-soluble form and vice versa. A map was made to show the content of Mn in the soils in all the different zones of the Ukraine. By granulating the powdery superphosphate with 10 to 15 per cent Mn slag and 3 to 4 per cent chalk, granulated manganese-plus-superphosphate was made. This is being applied on more than 2 million hectares of land. The manganese-plus-superphosphate increases the yield and sugar content in sugar beets, the yield and the content of protein and starch in grains of winter wheat and maize, the oil content in sunflower seeds, the ascorbic acid and sugar content in the fruits of strawberries and tomatoes, the bitter substances in hop bumps, and the starch and dextrin content in potatoes. In the mixture of grain and silage of maize plants, the content of zein was decreased, but the quantity of other protein fractions, which contain the amino acids, lysine, methionine, valine, and tryptophan, was increased. The economic efficacy of applying the manganese-plus-superphosphate in collective farms amounts to an average net profit per hectare of 58 roubles for corns, 439-800 r. for sugar beets and flax, and 1,935 r. for hops.

VOGT, MANFRED. *See* LIETH, HELMUT VON

VOSKRESSENSKAYA, N. *See* NICHIPOROVICH, A. A.

WADA, BUNGO, and SYÔITI SATÔ. University of Tokyo. *Electron Microscopic Studies of the Plant Mitotic Spindle.* Under the electron microscope, the fine structures of the spindle in PMC's treated with $CdCl_2$ solution were investigated in ultra-thin sections. The unit fibrils of the metaphase spindle which are oriented parallel to each other and to the long axis of the spindle, are 100 to 500 Å in width, while the chromosomal fiber forming a long thread and composed of 15 to 20 lines of fibrils, is compact near the kinetochore side. This fiber, too, is 0.4 μ in width and becomes loose at the polar regions of the spindle. The width of the fibrils found in a chromosomal fiber range from 200 to 700 Å. The cytoplasm appearing as roughly aggregated patterns is clearly distinguished from the spindle substance. The unit fibrils of the phragmoplast derived from the spindle fibrils by swelling and aggregation are 250 to 1,000 Å in width. From the time of its initiation, the cell plate appears as doubled layers, crossing vertically to the unit fibrils of the phragmoplast, and showing high density to the electron beam. The thickness of each layer and the distance between them are measured at 250 to 1,000 Å and 2,500 to 4,000 Å, respectively. Neither the so-called continuous fibers connecting both poles, nor that line of granules which had been thought to have developed on the interzonal connections, and to have transformed themselves into the cell plate, have been demonstrated in the ultra-thin sections.

WAGNER, WARREN H., JR. University of Michigan. *Problems in the Classification of Ferns.* The new classifications of ferns (including Holttum, Copeland, Ching, Dickason, Pichi-Sermolli, and Alston) differ greatly *inter se*. Our knowledge of ferns shows serious gaps. Even with the data, however, how do we read the morphological and other facts? Also, how are the data synthesized? And, finally, how do we apply the taxonomic categories? Examples of recently acquired knowledge of ferns prove that less guesswork is necessary. But the morphological trends and taxonomic evaluation of certain characters — leaf structure, sorus, venation, sporangium, spore, chromosome number — are not agreed upon. "Objective" methods to synthesize data may merely confirm the taxonomists' intuition, but may also, in some cases, improve our correlations. A major problem in ferns is "hierarchical inflation," wholesale elevation of taxonomic ranks. The proposed classifications demonstrate both areas of agreement and disagreement, and the latter will be examined. The gymnogrammeoid ferns appear to be separate from the *Dennstaedtia* group. A strong separation of thelypteroid ferns from the aspidioid group may be questioned. The *Davallia-Oleandra* assemblage may be an epiphytic offshoot of the aspidioid group. The *Blechnum* and *Elaphoglossum* groups are evidently also aspidioid. Whether *Dipteris* and *Cheiropleuria* are polypodioid ferns is dubious. The familial separation of the *Grammitis* group from the *Polypodium* group demands further evidence. An endeavor is made to point out some of the obvious problems calling for research.

WAIN, R. L. Wye College, University of London. *The Oxidative Metabolism of Certain Auxins and Their Derivatives within Plant Tissues.* In addition to detailed studies on the biogenesis of the natural auxin 3-indolyacetic acid (IAA), its oxidative destruction within plants has received considerable attention within recent years. The presence in extracts of certain plant tissues of enzyme systems which can oxidise IAA is now well established and the conditions under which such destructive oxidation occurs, the mechanism of the reaction and the possible importance of Mn^{++} have been studied by a number of workers. Investigations with homologues of IAA and aryloxyacetic acids have indicated that in certain plant tissues the aliphatic side chain can be degraded by β-oxidation. Evidence for this was obtained from the growth-regulating activity of the different homologues and by identification of compounds produced when they were metabolised in wheat-coleoptile or pea-stem tissues. The results from a large number of series indicate that wheat and pea tissues can show differences in their behaviour with some of these acids and that certain types of ring substitution can influence the degree to which β-oxidation of the side chain takes place. Some of these findings have been found to be important in relation to selective toxicity. The metabolism in wheat and pea-stem tissues of the homologous series of amides derived from ω-(2,4-dichlorophenoxy)-alkane carboxylic acids and the plant growth-regulating activity of these compounds has received attention. The behaviour in all cases was explicable in terms of the ready conversion of amide to acid in the tissues. The corresponding nitriles, however, were found to behave differently and evidence has been put forward that this is due to the occurrence of α-oxidation, that is, a new type of breakdown whereby the nitrile is converted to the lower carboxylic acid.

WAIN, R. L. *See* FAWCETT, C. H., *et al.*

WALDON, HOLLIS. *See* KURTZ, EDWIN B., JR.

Walker, J. C. University of Wisconsin. *Disease Resistance in Crucifers.* L. R. Jones initiated work in 1910 on development of varieties of cabbage resistant to yellows. Two inherited types are known. Multigenic resistance is built up by mass selection for modifying genes which are additive in effect, and restrict the expression of susceptibility which is controlled by a single recessive gene. A single dominant gene, which controls more complete resistance, is incorporated with or without multigenic resistance in many commercial varieties. The same gene occurs in wild cabbage, Brussels sprouts, kohlrabi, and probably in other cultivated forms of *Brassicae oleracea,* and is effective against the four races of *Fusarium oxysporum* f. *conglutinans* described so far. Mass selection of radish has yielded lines highly resistant to the radish and cabbage races. Resistance in cabbage to turnip mosaic virus and cauliflower mosaic virus is multigenic and incompletely dominant. Development of lines of cabbage resistant to *Plasmodiophora brassicae* is in progress. It is complicated by the existence of distinct pathogenic races of the pathogen. The relation of environment and host nutrition to expression of resistance and various methods of assay will be discussed.

Walker, J. M. University of Manitoba. *The Vegetation of Delta Marsh.* Lake Winnipeg, Lake Manitoba, and many smaller bodies of water are remnants of glacial Lake Agassiz which covered the southern part of the province of Manitoba and extended into neighbouring provinces and states in Pleistocene times. At the southern end of Lake Manitoba there is a series of narrow forested sandy ridges separating the lake from 35,000 acres of freshwater Phragmites marsh. The lake is subject to periodic fluctuations in water level, and in stormy high-water periods it breaks through the ridge and floods the marsh, greatly increasing the area occupied by water. In 1955, a year of unusually high water, hundreds of acres of marsh vegetation were inundated. By 1958 the water level had dropped more or less to the seasonal normal, exposing vast expanses of dead Phragmites and bare waterlogged mud. The pattern of colonisation and changes in vegetation on these bare areas, the re-establishment of Phragmites and the effects of the high water on vegetation throughout the marsh and on the ridge will be discussed.

Walker, Richard B., and Stanley P. Gessel. University of Washington, Seattle. *Greenhouse Studies of the Mineral Requirements of Conifers.* Seedlings of western red cedar (*Thuja plicata*), Sitka spruce (*Picea sitchensis*), and Douglas fir (*Pseudotsuga menziesii*) have been grown in sand and liquid nutrient cultures and in soil pot cultures in the greenhouse for periods of 6 to 30 months. Emphasis has been placed on the production of large plants showing "low level" or incipient deficiencies of both macro- and micro-nutrients. Methods of culture and data on mineral composition and mineral requirements of the plants will be illustrated by photographs and charts. Colored slides will be available for viewing which show the appearance of experimental plants and deficiency symptoms. The growth of young plants of these species on infertile sites in the field and their responses to fertilizer applications will also be illustrated.

Wallace, H. R. Rothamsted Experimental Station, Harpenden, England. *Factors Influencing the Ability of Heterodera Larvae to Reach Host Plant Roots.*

There is an optimal water distribution in soil pores for emergence of larvae from cysts of *Heterodera.* This is related to aeration and to the speed with which larvae can move through the oral and vulval apertures of cysts. The influence of root excretions on hatch in a particulate medium is described. *Heterodera* larvae have maximum mobility in soil whose particles are in the range 150–250 μ in diameter. In addition greatest movement occurs in soil whose pores have been drained of water, but where large amounts still remain at the points of contact of particles. Mobility in sand and clay soils of the same crumb size is similar, but in peat soil larvae of *Heterodera rostochiensis* appear to be able to move at much higher pressure deficiencies. In a soil with a moisture gradient, larvae move towards the region of higher moisture content and this movement increases as the gradient increases. It is also shown that in the absence of a moisture gradient, *Heterodera* larvae move downwards. The influence of percolating water on the movement of larvae in soil is described and it is shown that soil moisture content also influences attraction to and invasion of host plant roots.

WALLACE, J. M. University of California. *An Unusual Kind of Seed Transmission of the Avocado Sun-blotch Virus.* Most seedlings grown from avocado trees infected and showing symptoms of the sun-blotch virus disease are healthy and virus-free, but an occasional seedling becomes infected through seed transmission of the virus and develops characteristic symptoms. Some infected but symptomless trees have been discovered which produce seedlings all or nearly all of which are symptomless carriers of the virus. No seedlings of the latter type have developed sun-blotch symptoms and are unaffected when reinoculated, but when used as rootstocks they bring about infection of the scion top. The capacity to transmit virus through seeds to all or nearly all seedlings is passed on from one seedling generation to another. Avocado seedlings experimentally inoculated with sun-blotch virus develop characteristic symptoms of the disease, but later some of them produce symptomless shoots which eventually make up the major part of the trees. Seeds from fruits produced on a recovered limb produced seedlings which were symptomless carriers of the virus. This suggests the origin of trees which regularly produce diseased seedlings, some of which are known to have been used as rootstock parents by nurserymen and which have been responsible for a high percentage of disease in the nursery. These findings make it clear that the rootstock (seed) parent tree as well as the budwood parent source must be indexed for sun blotch to ensure freedom from the disease in nursery propagations.

WANG, C. H. *See* BRANDT, WILLIAM H.

WANG, CHI-WU, and T. O. PERRY. University of Florida. *Racial Variation in Slash Pine (Pinus elliottii) and Loblolly Pine (P. taeda).*

WANG, DALTON. University of Manitoba. *The Effect and Metabolism of Benzimidazole and Its Analogues in Healthy and Rusted Wheat Leaves.* The breakdown of resistance to *Puccinia gramminis tritiai* race 15B-1 in detached Khapli leaves can be reversed readily by treating the leaves with a solution of benzimidazole (>30 p.p.m.). The mode of action of this compound is not yet known. In an effort to elucidate this point, two approaches have been made. (1) Benzimidazole-2-C^{14} was fed to detached leaves and its metabolic progress was followed. It was found that this compound is readily taken up, metabolised, and incorporated as such into a more complex compound by the detached leaves. There are three unknowns appearing as free compounds in the alcohol-soluble fraction and one in a bound form in the nucleic acid fraction. All the unknowns have been partially characterised. (2) Benzimidazole analogues have been used to study their effect and interaction on benzimidazole and on the rust reaction. Evidence has been obtained indicating that the imidazole ring of benzimidazole is essential for the latter's function in restoring the rust resistance of the detached Khapli leaves.

WARD, GEORGE H. Knox College, Illinois *Adaptation and Modification in a Polyploid Complex.* The principal group from which examples are drawn is the *Artemisia tridentata* complex — the sagebrushes of Western North America — although consideration is given to the more general nature of some of the problems involved. The origin and evolution of the complex are discussed briefly, with cytological information supplemented by analysis of plants grown in a uniform garden environment. In this complex of closely related and morphologically similar taxa, there may be modifications of a race that is growing in varied ecological situations — modifications which may closely resemble genetically controlled differences between other members of the complex. Also, polyploid forms bring together and re-assort characteristics of two or more diploid races. Such a complexity of form and adaptation leads to much confusion in interpretation of taxa, and in the interpretation of the ecological roles of these plants in the field. Some mention is made of nomenclatorial and descriptive problems arising from this situation.

WARD, GORDON M. Plant Research Institute, Ottawa. *Carbohydrate Metabolism in Potassium-deficient Plants.* The accumulation of carbohydrates in plants and their distribution into various saccharide fractions are affected by the level of potassium in the tissues. This can be accounted for by the observation that potassium influences the level of activity in the growing plant of various carbohydrate enzymes. Invertase, amylase, starch phosphorylase, and enolpyruvic phosphoferase have been studied and are affected in varying degrees by potassium. The effects of environmental factors upon the activity levels of these enzymes have also been studied.

WARDLAW, CLAUDE W. Manchester University. *The Organization of the Shoot.* A dynamic conception of shoot organization, though difficult to formulate, is essential to causal and evolutionary interpretations of vascular plant morphology. Roots apart, a plant is basically an axis, potentially capable of unlimited apical growth, together with the lateral members which result from the morphogenetic activity of the apical meristem. Though diverse in detail, all vascular plants have this basic plan of construction. The characteristic development of a leafy shoot can be ascribed to two major phases and to certain pervasive relations. The primary morphogenetic activity of the organized apical meristem yields the basic pattern, including the inception and positioning of growth centres and the initial shape and symmetry of the nascent leaf and bud primordia, etc. This primary pattern is elaborated in the subapical and maturing regions by differential growth—a complex phenomenon involving genetic, environmental, and organismal factors—and the distinctive morphology of the species becomes manifest. Both phases yield evidence of pervasive developmental harmony and integrated unity. These fundamental developments and relations not only require and invoke observational, experimental, and analytical investigations in terms of metabolism, growth, and physico-chemical and organismal factors, but challenge our capacity to synthesize the information obtained.

WARDROP, A. B. C.S.I.R.O., Melbourne, Australia. *The Structure and Differentiation of the Secondary Plant Cell Wall.* The purpose of this communication is to review recent contributions relating to the structure and development of the secondary wall. Difficulties associated with the use of structural or ontogenetic criteria as a basis for defining primary and secondary walls are pointed out although the latter appears more satisfactory. The contribution of techniques in electron microscopy towards elucidating the physical texture of the cell wall is discussed. In addition, the contribution of these techniques in the study of characteristic features of the secondary wall such as layering and lamellation in algae and higher plants is discussed in relation to earlier optical investigations. The cell-wall organization of the different cell-wall layers of conifer tracheids and wood fibres, as well as the distribution of constituents within them, is described in detail. The structure of pits is considered in relation to the structure of the different layers of the cell wall. Evidence relating to the mechanism of cell-wall formation and lignification is presented and attempt is made to place these processes in perspective as phases in cell differentiation. New evidence is presented concerning the development, structure, and chemical nature of the wart structure in conifer tracheids.

WARDROP, A. B. C.S.I.R.O., Melbourne, Australia. *The Structure and Formation of Tension Wood.* The formation of tension wood in angiosperms is remarkable in that physiological changes taking place in response to environmental or intrinsic factors are reflected in well-defined anatomical changes. Tension wood is characterized by the presence of fewer and smaller vessels compared with normal wood and by conspicuously thickened fibres which are partially or wholly unlignified. In some instances analogous changes are observed in fibres of the phloem. The extent to which tension wood is formed varies greatly among genera and in some species is unknown although variations in the degree of lignification of the fibres may be observed. The formation of tension wood has variously been attributed to the operation of strains in growing stems, the influence of gravitation and to the operation of intrinsic factors governing tree form. Resulting from or associated with the development of tension wood, considerable growth stresses develop in stems and branches and movements of orientation take place. Physiological changes involved in these processes appear to be reflected in the changed anatomy and composition of the tissue. The amount of mobile water in tension wood is less than in normal wood. The purpose of the discussion presented is to review experimental evidence of factors which are considered to govern the formation of tension wood, and which relates the formation of tension wood to movements of orientation in stems and branches. The nature of possible mechanisms by which these movements are effected is discussed.

WAREING, P. F. University College of Wales. *Discussion on Dormancy in*

Woody Plants. There is much evidence that the mechanism of dormancy is the same in buds, seeds, and tubers. This is indicated, for example, by the similar responses of seeds and buds of *Betula* to chilling, long days, and gibberellic acid. Certain evidence points to the importance of growth inhibitors in bud dormancy. Thus, there is a seasonal variation in the level of growth inhibitors present in buds which is correlated with their state of dormancy. Exposure of seedlings to short-day conditions, which induces the formation of resting buds in many woody plants, results in an increase in the amount of growth inhibitor at the shoot apex. Nevertheless, it is not yet established that growth inhibitors play a controlling role in dormancy. It is unlikely that physical barriers to oxygen uptake are important in bud dormancy since photoperiodic experiments indicate that the formation of resting buds is induced by exposure of the mature leaves to short days, that is, by influences arising outside the bud itself. Attempts to determine the stages in metabolism which are blocked in dormancy have yielded conflicting results. The most promising approaches for future research on dormancy are discussed.

WAREING, P. F. University College of Wales. *Juvenility and Induction of Flowering.* In considering the changes which occur as a tree increases in size and age, it is necessary to distinguish between "ageing" and "maturation." The term "ageing" is applied to the gradual reduction in vigour occurring as the tree increases in size, as evidenced by the decreasing annual growth increment. This ageing is readily reversed on grafting an aged scion on to a young root-stock. Maturation is used to denote the attainment of the flowering condition, which is also associated with changes in certain other characters, for example, leaf shape and phyllotaxis. These latter changes are relatively stable, and are not normally reversed on grafting. The onset of flowering in a seedling tree seems to involve the attainment of a certain minimum size. In some species this size factor seems to be related to the ageing of the shoot system. This raises the question as to whether the process of ageing promotes the process of maturation, or whether ageing simply creates favourable conditions for flowering, once the mature condition has been attained.

WASSINK, E. C. Agricultural University, Wageningen, Netherlands. *Efficiency of Solar Energy Conversion in Field Crops.* Solar energy conversion data in algal mass cultures and higher plants have been reported from this laboratory. This paper presents results on potatoes (varieties "Bevelander" and "Eersteling") obtained in 1949, 1950, and 1951, and evaluated only recently. Each experiment had ten rows of ten plants; at three to four week intervals two rows were harvested. Fresh weight and soil surface area covered were established per plant, detailed dry weight and leaf area data were determined for six representative plants each harvest. Solar energy data were obtained from the physics department of this university, in cal./cm.^{2} or in minutes sunshine. A relationship between both was established graphically per month, and used in the computations if required. In sufficiently long summer periods, in Holland, minutes sunshine fairly equal cal./cm.^{2}. Efficiency (cal./cal., dry matter/photosynthesizable radiation on actually covered surface area) was about 0.05 (5 per cent) in June and July, and somewhat lower earlier: $>$ 0.01 to 0.02 for entire season (per cultivated area). Leaf area ratio (cm.^{2}/gm. dry weight) decreased from 120 to 20; leaf area index was about 2.5 to 3.5; net assimilation rate (gm. dry weight/day/cm.^{2} leaf surface) around 7 × 10^{-4} with irregular variation between May and August. Aerial and sub-soil dry weight equalled around June 24.

WATKIN, J. E., and A. C. NEISH. Prairie Regional Laboratory, National Research Council of Canada. *Biosynthesis of Quercetin in Buckwheat.* Further testing of carbon^{14}-labeled compounds as quercetin precursors in *Fagopyrum tataricum* (Gaertn.) is reported. The postulated central intermediate phenylpyruvic acid was a good precursor. L-phenylalanine and (-) phenyllactic acid were much better precursors than their stereo-isomers. Tyrosine, p-hydroxyphenylpyruvic acid, and p-hydroxyphenylactic acids were much poorer precursors than their unhydroxylated parent compounds in spite of the fact that a hydroxyl has to be added in the para position by the plant to form quercetin. N-acetyl-L-phenylalanine was as good a precursor as L-phenylalanine which suggests that it might be a natural intermediate. Although the bulk of the quercetin is found in the leaves of buckwheat, a defoliated stem synthesized quercetin at a rate equal to that of the whole shoot which suggests that the site of quercetin synthesis is in the stem.

WAYGOOD, E. R., and J. E. SMITH. University of Manitoba. *Enzymatic Changes in Rust-infected Sunflower Cotyledons.* Infection of sunflower cotyledons var. Foundation by *Puccinia helianthi* causes symptoms which include alterations in the concentration of enzymes catalysing metabolic reactions involving glutamic acid. Glutamic acid decarboxylase activity decreases with age more rapidly in infected as compared to uninfected cotyledons. An inhibitor appears to be associated with this decrease in activity, but when its effect is nullified the activity of extracts from infected plants may be restored to normal by the addition of pyridoxal phosphate. Glutamate-aspartate-transaminase which is also linked with pyridoxal phosphate shows an increased activity in extracts from infected cotyledons. In this case, the enzyme from normal tissue appears to be partially depleted of pyridoxal phosphate since it is susceptible to reactivation by this coenzyme. Enzymatic assays indicate that the concentration of pyridoxal phosphate is the same in both infected and uninfected cotyledons. A DPN-linked glutamic acid dehydrogenase also shows a higher level of activity in infected cotyledons, but this may be accounted for by the presence of the enzyme in germinated urediospores. Glutamic decarboxylase is absent from and transaminase is only weakly active in germinated urediospores.

WEATHERLEY, P. E. *See* MEES, G. C.

WEBER, WILLIAM A. University of Colorado Museum. *Some Features of the Distribution of Arctic Relicts at Their Austral Limits.* Many arctic and subarctic species reach their southern limits in the alpine regions of western United States. The greatest number occur in the Colorado Rocky Mountains, fewer in the mountains of California and Utah. The majority have more or less continuous ranges north to south wherever there are high mountains with tundra; others are widely disjunct between their arctic areas and the southern stations; a few are bipolar. The rarest disjuncts are those which appear to require especially stable mesic sites (*Koenigia, Phippsia, Saxifraga foliolosa, Primula egalik-*

sensis). Distribution of these rarities is not random or unpredictable, but limited to a few major areas of concentration, characteristically massifs which run east-west between the typical north-south ranges. Here the habitat remains mesic at high altitudes because of slow snow-melt in summer, a minimum of desiccation in winter, and short periods of direct sunlight. North-south oriented ranges have, by comparison, a relatively uninteresting Arctic relict flora. Species which are distinctly nitrophile or calciphile in the north do not necessarily have such associations in the south. The mesic relicts are taxonomically stable compared with their more xeric floristic relatives. Field studies at the austral limits by specialists acquainted with the arctic and subarctic representatives need to be encouraged.

Weber, A. V. *See* Miller, Helena A., *et al.*

Weeks, W. D. University of Massachusetts. *Foliar Analysis as an Aid in Interpreting Fertilizer and Preharvest Drop Control Studies of Apples.* Foliar analysis revealed levels of nitrogen and potassium in McIntosh apples which could not be related to fertilizer treatment. Medium and high rates of nitrogen without potassium were associated with deficient leaf symptoms and levels of potassium. Fruit color was related to low leaf potassium as well as high leaf nitrogen. High levels of nitrogen were not associated with annual bearing. Nitrogen levels were found to have as much effect on fruit softening as applications of the hormone 2, 4, 5-TP.

Weijer, Jan. University of Alberta. *Gibberellic Acid as a Gene Determinant in Impatiens.* In *Impatiens balsamina* L., two forms of flowering doubling are known to exist. The "double" type is due to petalody or to petalomany and is caused by a single recessive gene p_t. In the "camellis" type (genes c_a) doubling is due to petalody and petalomany; moreover, the terminal flowers are peloric double. The penetrance of the gene p_t in inbred lines is incomplete. Outbreeding of inbred double strains with single flowering strains will result in a 3:1 segregation for single and double flowers. Penetrance in inbred lines can be improved by enriching the soil, by topping at seedling stage, by spraying indoleacetic acid and related growth substances, and by spraying gibberellic acid. Of all these treatments an alternate-day spray with gibberellic acid will facilitate full penetrance of doubleness in inbred lines. No evidence was obtained to indicate that gene c_a is influenced by environmental conditions. The penetrance of this gene seems to be complete. It was found that by treating *Impatiens* with a spray of gibberellic acid (concentration 10^{-4} gm./1,000 ml.) on alternate days as well as with alternate-day spraying of indoleacetic acid (concentration 10^{-4} gm./1,000 ml.) internode extension, as a typical effect of gibberellic treatment, could be totally inhibited.

Weinstein, Leonard H., Boyce Thompson Institute, Yonkers, N.Y.; Louis G. Nickell and Walter Tulecke, Chas. Pfizer Co., Brooklyn, N.Y. *Biochemical and Physiological Studies on Plant Tissue Cultures and Plant Parts from which They were Derived.* The content of non-volatile organic acids, free amino acids, sugars, and protein amino acids of several plant tissue cultures and the plant parts from which they were derived will be discussed.

Weintraub, M. *See* Willison, Robert S., *et al.*

Weintraub, Robert L. Fort Detrick, Maryland. *Dormancy and Germination of Wheat Rust Uredospores.* Studies of the past few years have begun to provide an insight into the mechanisms of dormancy, germinability, and infectivity of wheat rust uredospores. It has been discovered that a large fraction of the spore population, usually regarded as dead because of its failure to germinate under ordinary test conditions, may in fact be only dormant and capable of being stimulated to germinate and infect. Dormancy and germinability are controlled by a system of endogenous inhibitors and stimulators. The balance of this regulatory system can be manipulated by various means so as greatly to increase or decrease the germinability and infectivity. One of the endogenous stimulators has been isolated and identified as pelargonaldehyde. A considerable number of other chemicals have similar physiological effects. These substances not only stimulate the initial germination of the spore but also induce the formation *in vitro* of subsequent developmental stages usually observed only in the host plant.

Wells, Kenneth. University of California. *Basidial Development in Sebacina mesomorpha Bourd. & Galz.* Studies were made from aceto-lacmoid smears and from paraffin sections stained with iron-alum hematoxylin and with aceto-carmine. The probasidium arises as a subcylindrical structure containing a pair of nuclei and is always subtended by a well-defined clamp-connection. The young basidium enlarges to become an obovate to sphaeropedunculate structure in which the large fusion nucleus is formed. The primary septum is formed following the first reduction division and, in most basidia from thicker specimens, diverges to delimit the fertile apical portion and the anucleate basidial stalk. Epibasidia arise following the second division of meiosis and the formation of the secondary septa. The uninucleate epibasidia often become separated from the hypobasidium by the formation of transverse septa. Basidiospores are uninucleate. An additional basidium may develop from a proliferation through or in the vicinity of the clamp-connection at the base of the older basidium. In most cases, the nuclear number in the proliferating fertile hypha is doubled by conjugate nuclear division and clamp-connection formation prior to the differentiation of an additional basidium.

Wesley, Alan. University of Leeds. *The Validity of the Genus Sphenozamites Brongniart.* As a result of the re-examination of some of the fossil fronds in De Zigno's collection of Jurassic plants, the author proposes that *Sphenozamites* should be retained as a valid generic name. Well-preserved cuticle from these specimens reveals that they belonged to the Bennettitales. A comparison between the Italian species and *Sphenozamites tener* Compter is offered, and it is shown that the latter species belonged to a different group of gymnosperms. Since De Zigno's specimens were named before *Sphenozamites tener*, the generic designation must be retained for pinnate bennettitalean fronds on which the pinnae narrow in a wedge-shaped manner.

Wetmore, R. H., and Rhoda Garrison. Harvard University. *The Growth and Organization of Internodes.* The shoots of higher plants possess two fundamental patterns of development distinguished basically by the degree of stem elongation. In short shoots, the opening of a bud is followed by leaf maturation but with no significant internodal growth. By contrast, in long shoots, extensive internodal elongation characteristically occurs after the initial stage of bud opening. Even among recognized long shoots, differences in behaviour are evident. In some plants shoot growth is the resultant of several internodes maturing concurrently, whereas in other species the successive internodes develop stepwise, one by one. Growth due to the activity of what has been interpreted as an intercalary meristem is not common but is found among the grasses and in *Equisetum*. Study of the shoots of *Syringa vulgaris* and *Helianthus annuus* has shown the orderly progression of growth within individual internodes and the relative roles of cell division and cell elongation in the development of the growth pattern. During the earliest phase, growth takes place throughout the very short internode; subsequently it becomes progressively localized in the upper part, and a wave of maturation proceeds gradually from the base in an acropetal direction. As an internode matures, the supra-adjacent nodal region shows definite elongation resulting in certain cellular adjustments which add to the stature of the adjacent internodes. The distribution of auxin as it is related to stem growth is also given consideration.

WETTSTEIN, DITER VON. University of Stockholm. *Nuclear and Cytoplasmic Factors in Development of Chloroplast Structure and Function.* In recent years it has become possible to relate the development of submicroscopic plastid structures, as studied by electron microscopy, with the formation of pigments and other chemical changes in the chloroplasts. Environmental and genetic factors can block the normal development of the plastid structures in various ways. In several cases these blocks can be associated with the failure of pigment synthesis or with the failure of the incorporation of pigments into the plastid structures. Thereby it is possible to characterize the submicroscopic components of the chloroplast. In addition, isolated particles, which are able to carry on certain functions of the chloroplast, can be compared with the structural components of the chloroplast *in situ*. The effect of gene mutations on the development of chloroplasts was studied in barley and will be compared to the effect of plasmatically inherited factors in *Humulus and Nicotiana*. The implications of these studies on the nature of the nuclear and cytoplasmic control of chloroplasts will be discussed.

WEURMAN, C. Central Institute for Food and Nutrition Research, T.N.O., Netherlands. *Pectic Enzymes in Pears during Development and Maturation.* Evidence for the presence of "pectinase-like" enzymes in finely ground fruit tissue can be obtained by comparison of the relative amounts of water-soluble and insoluble pectin when the experiments are carried out in series with fruit of successive stages of development. The main difficulties, however, in demonstrating these enzymes in pears by direct measurements of their action are caused by the existence of different types of "pectinase" inhibitors in the fruit. These inhibitors have to be eliminated or the ratio of their activity over the activity of the enzyme has to be reversed before proof for the presence of the enzymes can be gained. Because of the pectinesterase of the tissue and tissue extracts precautions are necessary when the demonstration of the presence of "pectinase" is based on viscosimetric methods. "Pectinase" could be shown to be present in pears by direct measurement of its activity in one single stage of development only.

Whaley, W. Gordon, Hilton N. Mollenhauer, and **Joyce E. Kephart.** University of Texas. *Ultra-structure, Physiological, and Biochemical Changes with the Development of the Cells of the Maize Root.* The ultra-structure of the promeristematic cells of the maize root is considered with respect to the ground substance of the cytoplasm, mitochondria, the Golgi apparatus, proplastids, the endoplasmic reticulum, and the nuclear envelope. Changes in each with development of the cells in the different tissue regions of the root are considered. These changes are correlated with respiratory level, carbohydrate and lipid content and metabolism, ascorbic acid oxidase, and certain other biochemical constituents.

Wheeler, Louis Cutter. University of Southern California. *Typonymous Organization of Synonymy.* Customarily synonymy in taxonomic papers is arranged chronologically because of the importance of priority. Now that the concept of types is recognized as a prime principle coordinate with priority it would be well to combine the two considerations in listing synonymy, thereby clarifying the basis of the names listed. In addition to showing nomenclatural relationships between names, the basis of the revising author's conclusions can be shown succinctly by citing with each group of typonyms the type, and, for specific and infraspecific taxa, whether he has seen it, where it is deposited, and its biological position in the concept. Too many authors may give some information about the type of the name which they have decided to use, but often relegate all information about their knowledge of types of names which they consider synonymous to obscure positions scattered through "Collections Cited," if indeed they give any indication of the basis of their conclusions. In large complex genera, for example, *Euphorbia,* from which many smaller genera have been segregated and which have wide-ranging variable species, to attempt to infer the nomenclatural relationships among a group of chronologically arranged taxonomic synonyms is often impossible.

Whisler, H. C. *See* **Emerson, Ralph**

Whittaker, R. H. Brooklyn College. *Species Diversity in Plant Communities.* Species diversity is a fundamental characteristic of plant communities, but one which has been little studied, whose meaning and relations to environment are little understood. Despite the familiar decrease in numbers of species from the tropics northward, community diversities are not in any simple way correlated with environmental "favorableness." Studies in the Siskiyou Mountains of southwestern Oregon show that species diversity of individual stands increases markedly from the humid, coastal redwood forests inland to drier environments, increases from low to middle elevations, and increases from normal to serpentine soils. Herbs make up half or more of the flora of these temperate communities, and those conditions which imply high herb-stratum diversity imply also high community diversity. Maximum herb-stratum diversities, and consequently maximum community diversities, occur not in the densest forests of humid and low-elevation environments, but in the more open communities of middle elevations and drier forest climates — in intermediate rather than "most favorable" conditions — and in the special open forest communities on serpentine. Vegetational diversities in a different sense — the range of community differentiation along the topographic moisture gradient — also increased markedly from the coast inland toward more continental climates.

WHITWORTH, J. W. *See* MUZIK, T. J.

WIESLANDER, A. E. Berkeley, California. *California's Vegetation Maps.* This paper is supplemented by an exhibit of the California maps outside of the symposium. It tells briefly why and how these maps are made, what they show, and discusses uses to which they are put. The maps are of two kinds and vintages. The first kind comprises vegetation type maps, scale 1:125,000 and scale 1:62,500, produced between 1927 and 1942 by a project that mapped 40 million acres; the second, timber stand — vegetation cover and soil — vegetation maps, scale 1:31,680, produced by a current project begun in 1947 that has mapped to date more than 7 million acres. Aerial photographic methods are used and vegetation and soils are mapped in one operation. The primary objective of both the earlier and current projects is to collect basic information of value for multipurpose management of uncultivated mountain and foothill lands, excluding desert areas.

WIGHTMAN, F., and A. C. NEISH. Prairie Regional Laboratory, National Research Council of Canada. *The Influence of Plant-growth Regulators on Cell-wall Metabolism.* It has become increasingly apparent from recent studies on the mechanism of auxin action that these compounds stimulate cell growth by acting directly or indirectly upon the cell wall. A possible mode of action may involve the formation of new cell-wall material and this has been examined by determining the effect of auxin on the rate of incorporation of carbon-14 into the cellulose and hemicellulose fractions of wheat coleoptile and pea stem segments treated with uniformly labeled sucrose-C^{14}. Growth in length and the rate of water uptake of the segments during the relatively short experimental periods have also been determined. The two growth regulators used were 3-indolylacetic and 2:4-dichlorophenoxyacetic acid. The results indicate that the carbon atoms of sucrose-C^{14} were rapidly incorporated into the two major wall constituents examined and that the rate of incorporation was considerably enhanced in the presence of IAA or 2:4D. Changes in the rate of protein metabolism during auxin-induced growth is also being investigated using C^{14}-labeled intermediates and the results will be presented.

WIGHTMAN, F. *See* FAWCETT, C. H., *et al.*

WILCOX, HUGH. State University of New York. *Vascular Tissue Differentiation in Roots.* The nature of the factor or factors involved in determining the organization of the vascular pattern is of fundamental importance in the study of the vascular differentiation in roots. Investigations on *Abies procera, Libocedrus decurrens*, and *Pinus resinosa* are evaluated according to the various conceptual schemes employed by morphogenesists, such as the role of stelar size, polarity, and the reciprocal inhibition between sites of active differentiation. Various anatomical stages of primary vascular tissue differentiation in these species are related to stage of growth activity and to the type of root. The cyclic growth behavior of individual roots is a manifestation of naturally occurring fluctuations in biochemical processes which are related to the ontogenetic changes. The organizing factors affecting the differentiation of vascular tissues may be elucidated, perhaps, from a study of differences in metabolic patterns associated with the histological and growth changes.

WILCOX, M. W. *See* BANKS, HARLAN P., *et al.*

WILDE, S. A. University of Wisconsin. *Ameliorating Effect of Jack Pine (Pinus banksiana) and Red Pine (Pinus resinosa) Plantations Established on Depleted Sandy Soils of Wisconsin.* The study was conducted on sandy soils of glacial outwash which were depleted by previous agricultural use and fallowed for a prolonged period. Twenty-nine years ago, these soils were reforested by planting two-year-old seedlings of either jack pine or red pine. The analyses of soils from adjacent areas of cut-over land and forest plantations of the two tree species included the determination of reaction, exchange capacity, the total and available nitrogen, available potassium and phosphorus, exchangeable calcium and magnesium, and microbiological activity. The results revealed an appreciably higher level of fertility in soil supporting the red pine plantation than in soil supporting the jack pine plantation, and especially that of the cut-over area. The ameliorating effect of red pine is attributed to its inherently high photosynthetic capacity, well-developed and deeply penetrating root system, and the efficiency of chelating compounds of root sloughings, facilitating the release of available nutrients from micas, feldspars, and ferro-magnesian minerals.

WILLISON, ROBERT S., M. WEINTRAUB, and J. H. TREMAINE. Canada Department of Agriculture. *Physical Studies on Some Stone-fruit Viruses.* Infective preparations of cherry yellows virus (CYV) and necrotic ring spot virus (NRSV) were made from infected cucumber tissue by differential centrifugation after clarification by dilution with or by dialysis against acetate buffer, pH 5.0 and 4.5 respectively. Both viruses are spherical particles, approximately 40 mμ in diameter, with a sedimentation rate of 70-73 S, and a characteristic ultraviolet absorption spectrum. They have some antigenic properties in common. NRSV, however, is the less stable, losing infectivity and fragmenting under certain conditions. For example, NRSV preparations clarified by dilution contained a considerable proportion of particles about 30 mμ diameter, with a sedimentation rate 30-32 S. Their ultraviolet absorption spectra indicated some release of protein. In preparations from cherry petals held two weeks at 4° C., NRSV was associated with 34 S particles and CYV with 70 S particles. Extracts of healthy cucumber contained either traces of materials or proteinaceous particles mostly 20 mμ or less in diameter, with sedimentation rates of 17 S and 26 S. Antigens prepared from infected cucumber sources reacted in agar gel with homologous antiserum and with virus antiserum derived from cherry petal sources and vice versa.

WILLSON, ALLEN F. Minute Maid Groves Corporation, Plymouth, Florida. *Leaf Analysis and Fertility Control in Commercial Citrus Production.* During the past eight years a program of analytical services has been developed for approximately 20,000 acres of citrus in Minute Maid Groves Corporation. It has been based on a sampling procedure with established confidence limits. Because of the variability of 20-acre blocks of citrus the random sampling procedure was not sensitive enough to detect the early stages of manganese, zinc, magnesium, or potash deficiency. It has been more practical to use the early occurrence of deficiency symptoms in occasional branches as the guide to fertilization for all these elements except potash. Leaf analysis was found to be of little value for making small changes in the potash program with predictable results the next year. Fruit drops were found to be related to leaf potassium in controlled experimental plots. Under Florida conditions and the sampling method used, a lower limit of 1.0 per cent potassium in random samples of six- to eight-month-old spring flush leaves from non-fruiting twigs has been recommended for fertilizer control purposes. Correlation studies between leaf potassium and the fruit solids produced in commercial Valencia and Pineapple blocks have demonstrated the value of avoiding excess potash.

WILSON, EUGENE M. University of California. *Photo-inhibition of Bean Rust.* Uredospores of *Uromyces phaseoli* var. *typica* (Pers.) Wint. are sensitive to light of low intensity. This sensitivity, as is indicated by photo-inhibition of germination, appears to vary from spore harvest to spore harvest. These spores require between 2 and 2.5 hours of darkness for germination when other conditions are favorable. Germination increases as the intensity of ultraviolet or light from a tungsten filament decreases. Moonlight at an intensity of about 0.02 foot-candles apparently reduces the percentage of germination of these spores. Photo-inhibition of spore germination occurs on susceptible host tissues as well as on the surface of aqueous agar. The tissue surrounding a rust pustule may become necrotic after a period of low light intensity. Starch accumulates in a zone surrounding the pustule on a bean leaf. This starch does not disappear until after two days of darkness. This is about 36 hours after the starch in the healthy tissue had disappeared. Evidence indicates an increase in anabolism in rusted tissue when in the light.

WILSON, L. R. Oklahoma Geological Survey. *Plant Microfossils from the Flowerpot Shale (Permian) of Oklahoma.* The Flowerpot shale is a Middle Permian formation cropping out in southern Kansas, west-central Oklahoma, and northwestern Texas. It is a marine redbed deposit, and no plant megafossils have been reported from it. The plant microfossils are abundant in some strata, and consist of a recognized flora of 33 spore and pollen species. The important genera are *Calamospora*, *Laevigatosporites*, *Anguisporites*, *Nuskoisporites*, *Pityosporites*, *Platysaccus*, *Lueckisporites*, *Ephedripites*, and *Vittatina*. Conifer pollen species are the most abundant element in the Flowerpot shale, but gnetalean pollen are also important. Spores are relatively less frequent than pollen, probably because the habitat of deposition is a marine shale, and saccate pollen species of the conifers are best adapted for widespread eolian distribution. The Flowerpot shale flora appears to be most closely correlated with the Zechstein flora of Europe which is also of Middle Permian age.

WILSON, P. W. *See* BERGERSEN, F. J., *et al.*

WIMBER, DONALD E. Brookhaven National Laboratory, New York. *Chromosome Fragmentation in Tradescantia paludosa Root Tips Produced by Tritium-labeled Thymidine.* The root tips of *Tradescantia paludosa* were examined for chromosome breakage after having been grown in 1 and 2 μc./ml. H^3-thymidine for varying lengths of time. Up to 31 fragments per 100 anaphase cells were found in roots grown for 4 to 8 hours in 2 μc./ml. H^3-thymidine and then transferred to isotope-free solutions for further growth before fixation. The higher fragment frequencies could be related to the period during which the maximum amount of H^3-thymidine was incorporated into the DNA. As many as 72 fragments per 100 cells at anaphase were demonstrated after continuous exposure of root tips to 1 μc./ml. isotope solution for times up to 56 hours. Autoradiographs of these root squashes showed that the average activated silver grain count over dividing nuclei increased as the fragmentation appearing at anaphase increased. Cells that absorbed large quantities of H^3-thymidine as measured by autoradiographs were seemingly arrested in their development before entering mitosis. Phenotypic alterations in flower color (presumed somatic mutations) have also been produced by incorporated H^3-thymidine. (This investigation was carried out while the author was a Public Health Service Research Fellow of the National Cancer Institute (CF-8465) and at Brookhaven National Laboratory under the auspices of the U.S. Atomic Energy Commission.)

WINTERMANS, J. F. G. M. *See* BENSON, A. A., *et al.*

WISER, R. *See* BENSON, A. A., *et al.*

WITHNER, CARL L. Brooklyn College. *Phytic Acid-phosphate Relationships in Inbred and Hybrid Corn.* Many investigations of heterosis have been concerned with size factors and growth rates. We have felt a more rewarding approach would be to compare the rates at which endosperm or cotyledonary reserves, especially phosphates, are mobilized for combination with compounds essential for energy release and growth. Various inbred and hybrid corn seedlings are being analyzed at 24-hour intervals from 0 to 96 or 120 hours. The following components are being followed in the endosperm, cotyledon, root, and shoot of the seedlings: total and inorganic phosphate, phytic acid, and in certain cases inositol. Phytase activity is also being determined in seedling tissues. Phytic acid occurs in higher quantities in cotyledonary tissue than in endosperm, and very little is transported to root or shoot. The amounts of inositol are less than would be expected for the quantity of phytic acid disappearing. Phytase activity is higher in the hybrid than in inbred corn lines so far investigated, and there is a greater relative rate of phosphate translocation from endosperm to seedling, especially up to 72 hours. Inorganic phosphate increases at a faster rate in the hybrid during germination. The implications of these facts in relation to hybrid vigor are being considered.

WITHNER, CARL L. *See* ADAMS, HELEN H.

WITTWER, S. H., and M. J. BUKOVAC. Michigan State University. *Absorption and Distribution of Foliar Applied Nutrients.* Foliar absorption rates for labeled rubidium, sodium, potassium, chlorine, zinc, magnesium, calcium, sulfur, phosphorus, manganese, iron, and molybdenum, as determined by several techniques were in the approximate order listed, and varied from less than 6 hrs. for 50 per cent absorption for rubidium to 14 days for phosphorus and even longer for iron and molybdenum. The effects of treating bean and tomato plants with various growth substances such as 2,3,5-triiodobenzoic acid, 2-naphthaleneacetic acid, maleic hydrazide, gibberellin, 2,4-dichlorophenoxyacetic acid, and 2,3,6-trichlorobenzoic acid on the distribution of foliar applied calcium, iron, and zinc will be presented.

WITTWER, S. H., and N. E. TOLBERT. Michigan State University. *Plant Growth Regulation by N-trimethyl-2-chloroethylamine Chloride.* N-trimethyl-2-chloroethylamine chloride and several related compounds greatly modify the growth of the tomato and other plants. Solutions of 10^{-7} to 10^{-3} molar in the root medium, or sprayed on the foliage, stepwise reduce internode lengths, increase stem and leaf thickness, and intensify the green coloration of leaves and stems. Flowering, however, is accelerated. Days from seeding to first anthesis and nodes preceding the first inflorescence are reduced, and flower numbers are increased. Differences in growth and flowering are most pronounced at high temperatures and under long days of low light intensity. The chemical mimics the effects on plant growth and flowering of a low temperature in combination with high light intensities of wave lengths predominating in the blue. N-trimethyl-2-chloroethylamine chloride and gibberellin applied to the root media of plants grown in soil or in solution cultures are mutually antagonistic. The enhancement of green coloration, shortening of internodes, increased stem thickness, and differences in flowering at 10^{-6} molar N-trimethyl-2-chloroethylamine chloride are completely negated by 10^{-6} molar gibberellin. Likewise, N-trimethyl-2-chloroethylamine chloride modifies the response to gibberellin. N-trimethyl-2-chloroethylamine chloride at 10^{-3} molar inhibits lettuce seed germination in the dark at 26° C., and this inhibition is overcome by 3×10^{-5} molar gibberellin. N-trimethyl-2-chloroethylamine chloride is not active in fruit setting.

WOLKEN, JEROME J. Biophysical Research Laboratory, Eye and Ear Hospital and University of Pittsburgh School of Medicine. *Electron Microscopy of Algal Structures.* The techniques of increased resolution with the electron microscope of biological structure, along with those of biochemistry, now make it possible to bring the study of cellular structures to a molecular level. Our interest in high resolution microscopy in photosynthetic organisms has been in resolving the photoreceptor structure at as high a resolution as possible along with the study of their pigment synthesis and how these are related to their ability to carry on photosynthesis. Certain algae as well as the photosynthetic bacteria that are easily grown in the laboratory were selected for a comparative study of their photoreceptors (chloroplasts, chromatophores, eyespot). These include the green flagellates, as well as the blue-green and green algae. The electron-microscopic studies indicate that the photosynthetic pigments are most probably oriented either on the surface of the discs (lamellae) or on the surface of chromatophores (grana) in an organized molecular packing. These structural aspects of the chloroplast will be illustrated along with those of other cellular structures. Electron micrographs, spectral data, and some ideas of the functional aspects will be discussed.

WOOD, RICHARD D. University of Rhode Island. *The Characeae.* Through a study of thousands of specimens, current collections and original types or substitute types, a new revision of the Characeae of the World has been assembled. The illustrations were made by Dr. Kozo Imahori, who worked with the author for two years under a National Science Foundation grant. A large number of species were assigned to synonymy, and a number of previously described infraspecific groups have been raised to species level. The organization of superspecific taxa has been brought into accord with the existing nomenclatural code, thus replacing most of the previously used names. It is of interest that the actual classification scheme is most like that developed by Alexander Braun in 1867 (Monatsber. K. Akad. Wiss. Berlin, 1868). Keys, synopses, and descriptions will help taxonomists the world over.

WOODBRIDGE, C. G., N. R. BENSON, and L. P. BATJER. State College of Washington, Fruit Experiment Station, Wenatchee, Washington, and U.S. Department of Agriculture. *Nutrition of Fruit Trees in the Pacific Northwest.* The principal fruit-growing areas of the Pacific Northwest are just east of the Cascade Mountains in the state of Washington, and in British Columbia, Canada. The rainfall is only 6 to 14 inches per year, and irrigation is essential for successful production of stone and pomaceous fruits. This region has relatively mild winters and warm summers with much sunlight, allowing crops such as cherries, apricots, peaches, pears, and apples to reach perfection. The soils are variable, but sandy loams predominate. These soils have been used commercially for fruit production for up to eighty years. Most plantings are much younger. In all soils, nitrogen has been the principal fertilizer required. There are no instances of tree response to potash and phosphorus fertilizer in the major fruit-growing areas. Deficiencies of boron and zinc are common. Deficiencies of manganese and magnesium are not of great economic importance. Owing to poor orchard management practices, occasional boron and manganese toxicities have been recorded. Nitrogen requirements of fruit trees are met by the annual application of inorganic compounds, with anhydrous ammonia being used to a limited extent. Requirements for other nutrient deficiencies are mainly satisfied by the use of a spray containing the necessary element and is applied during the late dormant or summer months.

WOODIN, HOWARD E. Middlebury College. *A Method to Correlate Climatic Change with Species Adaptation or Re-distribution.* The assumption that plant species will reflect climatic change by exhibiting morphological adaptation or re-distribution is basic to the interpretation of paleobotanical records as indicators of past climates. In order to validate this assumption, permanent transects, located within the tension zone immediately above alpine timberlines, would be a source of invaluable information. These transects, checked at regular intervals by systematic collections and quantitative analysis of species composition, could be correlated with the type of meteorological data we now and will have available to determine how closely allied are climatic change and plant evolution or distribution. Alpine areas offer excellent opportunities for permanent transect study since the zone directly above the boreal tree line will reflect changes perhaps more quickly than any other habitat. Coupled with this is the fact that, due to increasing population pressure on the land, in the near future only those areas unsuited for exploitation will remain undisturbed. To this end one 300-foot line-transect has already been placed on Mt. Marcy in New York State by the contributor. Percentage of ground cover was recorded on the line and type specimens were collected. Complete information as to methods involved in the transect placement are reported in the April 1959 *Ecology*.

WOODS, PHILIP S. Brookhaven National Laboratory, New York. *Ribonucleic Acid Metabolism and Function of the Cell Nucleus.* Tritium-labeled cytidine in conjunction with autoradiograph techniques was used to study ribonucleic acid (RNA) metabolism in root-tip cells of *Vicia faba.* It was shown that with continuous treatment radioactivity appeared first in the nucleolus and later in both nucleolus and cytoplasm. In experiments where the cells were treated long enough so that only nucleoli were labeled, the label was shown to move from the nucleolus to the cytoplasm with further growth in a non-labeled medium. These observations will be discussed in consideration of hypotheses that relate RNA as the carrier of genetic specificity from the deoxyribonucleic acid of the chromosomal gene to sites of protein synthesis in the cytoplasm. The work of other investigators will be reviewed. (Research carried out at Brookhaven National Laboratory under the auspices of the U.S. Atomic Energy Commission.)

WORLEY, J. F. *See* SCHNEIDER, I. R.

WRIGHT, D. *See* BROWN, STEWART A., *et al.*

WRIGHT, ERNEST. Oregon Forest Lands Research Center. *Formation of Mycorrhiza on Douglas Fir Seedlings.* Regeneration studies of Douglas fir in western Oregon on burned and unburned areas show digit or finger-like ectotorophic mycorrhiza after the first needles and lateral roots are well developed. A loose, brown, septate, mycelial mantle envelops the root tips and clamp-free hyphae extend profusely into the soil. On two-year-old seedlings the mantle is a compact, grayish, racemose formation, but retains its digit-like characteristic. One mycorrhizal-forming fungus has been tentatively identified as *Cenoccocum graniforme.* One-year-old forest-grown Douglas fir will develop 10 to 15 individual mycorrhiza on the roots while two-year-old seedlings show 10 times this number. On year-old seedlings, initial depth of mycorrhiza is related to the severity of the burn. Abundance of mycorrhiza, however, is not associated with the degree of burn or soil acidity. Duff and other soil covering do not significantly influence the number of mycorrhiza. Depth of mycorrhiza is somewhat deeper on seedlings exposed to full sunlight than under partial shade. Largest number of mycorrhiza is on seedlings receiving one-quarter shade, approximately one-half as many occur under three-quarters shade, and none on weak seedlings receiving only 200 ft. candle power insolation. The least extensive root systems have the most numerous mycorrhiza.

WRIGHT, JONATHAN W. Michigan State University. *Seed Orchards or Test Plantings?* It is safe to assume that in the majority of instances selection can be continued for several generations without diminishing results. But long-term selection goals can be achieved only from a long-term program involving several generations. This will entail progeny testing. The question arises as to whether these progeny tests can in themselves serve as interim seed orchards for the production of the highest quality seed tested up to the time they are established. For most genetic situations they can. For example, with additive variance trees pollinated by their genetic equals can be expected to give progenies equal to themselves, and there would be no genetic gain or gain in seed yield from the establishment of special clonal seed orchards. If two-parent progeny testing is used, the test plantations are far superior to special orchards as producers of genetically improved seed for testing and commercial planting purposes.

WRIGHT, JONATHAN W. *See* BINGHAM, R. T., *et al.*

Wycherley, P. R. Rubber Research Institute of Malaya. *Seed Germination of Some Tropical Legumes. Calopogonium mucunoides* Desv., *Centrosema pubescens* Benth., *Flemingia congesta* Roxb., and *Pueraria phaseoloides* Benth. are legumes commonly employed as cover crops and green manures in Malayan agriculture. The proportion of hard seed which will not germinate readily without pretreatment varies. Field establishment may fail or heavy seeding rates become necessary if the proportion is high, which often occurs. Treatments with concentrated sulphuric acid or hot water have been applied to improve germination. The former is difficult on a large scale and the latter is now shown to be frequently ineffective: both increase the susceptibility to drought in the field. The influence of storage conditions on the proportion of hard seed, the failure of potassium gibberellate and kinetin to improve germination to a satisfactory degree, the effects of infra-red irradiation, mechanical scarification, and a new treatment with glycerine on germination are reported.

Yakovlev, M. S. Academy of Sciences, Leningrad. *The Main Groups of Polyembryony in Higher Plants.* An attempt has been made to give a classification of the main groups of polyembryony on a historical and genetic basis. Polyembryony is widely spread among higher plants. The simplest form of polyembryony is to our notion the gametophytic-archegoniate one; it occurs when the gametophyte contains several archegonia, of which every one may develop into an initial of a new individual, as in Bryophyta, Psilopsida, Lycopsida, Sphenopsida and Pteropsida. In the gymnosperms the number of the archegonia is reduced but the gametophytic-archegoniate polyembryony is still possible. At the same time in the gymnosperms there arises a new mode of multiple embryo formation, the cleavage of the zygote followed by the regeneration of the primary blastomeres into new embryonal primordia. The phenomenon of polyembryony is of more varied character in the angiosperms. Here two groups of polyembryony may be distinguished. First, the gametophytic-gametic group including all the instances of embryo formation from the potential elements of the embryo sac. The latter may be considered as a germinated macrospore giving rise directly to the sexual cells — gametes — without the formation of the gametophyte tissue and its derivatives — archegonia. The second group, the gametophytic-sporophytic polyembryony, is a result of the regeneration processes in the zygote and embryo as well as of the development of the nucellar cells. The following classification of polyembryony is thus indicated: (1) the gametophytic-archegoniate, (2) gametophytic-gametic and (3) gametophytic-sporophytic; these major groups may be subsequently subdivided into types according to the mode of twinning.

Yakovlev, M. S., and M. D. Yoffe. Academy of Sciences, Leningrad. *On a New Type of Embryogenesis in Paeonia L.* The problem of the origin of the angiosperms is closely connected with a knowledge of the members of the order Polycarpicae, which has been placed at the base of the phylogenetic system of the angiosperms. It is from this point of view that the genus *Paeonia* attracted our attention in connection with the presence of a coenocytic phase in its embryogenesis as first described in 1951. The material used for the investigation includes *P. anomala, P. tenuifolia, P. wittmanniana,* and others. The ovule of *Paeonia* is crassinucellate, bitegmic. The megasporogenesis is characterized by numerous (up to 11) megaspore mother cells giving rise to several embryo sacs which fuse with one another. The majority of the megasporocytes disintegrate.

The development of the embryo sac follows the normal scheme. Four groups of sporogenous cells may be distinguished in the anthers of *Paeonia*. The divisions of the microspore mother cells proceed simultaneously. The tapetum is of the secretory type. The mature pollen is two-celled. The generative cell divides in the pollen tube. Some instances of double fertilization were observed. The development of the embryo in different species of *Paeonia* differs from that of other angiosperms. The first division of the zygote is not followed by wall formation. Several of the subsequent divisions are also free nuclear, the nuclei being distributed evenly along the periphery while the centre is occupied by a large vacuole. Cell formation in the coenocyte begins from the periphery but it does not directly result in an embryo. Instead, certain peripheral cells of this peculiar structure, named by us proembryonal, form meristematic centres which give rise to embryonal primordia. While there are several such primordia only one generally develops into an embryo. In *Paeonia* the coenocytic condition, lacking in other angiosperms and innate to the gymnosperms, is thus observed. We are inclined to think that the data given above present a strong case against the opinion held by many taxonomists of the barrier existing between the angiosperms and gymnosperms.

YAKOVLEVA, V. I. *See* KRETOVICH, W. L.

YAMADA, YUKIO, and M. TATEWAKI. Hokkaido University, Japan. *Life History of Monostroma.* Since the elucidation of the life history of *Monostroma nitidum* by Kunieda, the same type of life history has been reported in *M. angicava, M. wittrockii*, etc. But it is noteworthy that some other species included in the same genus show other types of life history. In this connection, we have already reported the results of our culture experiments on *M. pulchrum* and *M. zostericola*, in 1938 and 1941 respectively. At that time we concluded that the formation of the gametes was absent in *M. zostericola* and that in *M. pulchrum* the zoospores were formed twice in the life history, but the sexual phase was lacking. Recently we tried the same culture experiments again, and in *M. pulchrum* we reached the same conclusion, but in *M. zostericola* we confirmed the formation of the sexual phase.

YAMAMOTO, Y., and H. BEEVERS. Purdue University, Indiana. *Malate Synthetase in Higher Plants.* Malate synthetase, which produces malate from glyoxylate and acetyl-coenzyme A, is a key enzyme in the recently discovered glyoxylate cycle. This cycle has been implicated in the conversion of fat to carbohydrate in germinating castor beans (H. L. Kornberg, and H. Beevers, Biochem. Biophys. Acta *26:* 531, 1957). Malate synthetase and other enzymes of the cycle were found in this material. We have now developed a simpler assay system for the enzyme and investigated its properties and distribution. Like isocitritase (W. D. Carpenter and H. Beevers, Plant Physiol., in press) malate synthetase activity is particularly high in those parts of seedlings in which fats are being broken down during germination (castor bean, soybean, peanut, watermelon, and sunflower). By contrast, the neighboring parts of the seedling proper provide extracts with only low activity. Some activity was also found in pea cotyledons, *Vigna sesquipedalis* cotyledons, corn embryo, and maturing castor bean endosperm. Malate synthetase activity increases strikingly during the first few days of germination of the castor bean. The enzyme is apparently associated with particles sedimenting from sucrose phosphate homogenates between 800 and

70,000 xg but is easily eluted by dilute phosphate. Such solutions have been fractionated with ammonium sulfate to yield preparations with a specific activity some 40-fold higher than that of the crude extract.

YAMANAKA, T. *See* HORIO, T., *et al.*

YAMASHITA, J. *See* HORIO, T., *et al.*

YARWOOD, C. E., and RAYMOND LOUIE. University of California. *Response of Plants to Root Infection with Tobacco Necrosis Virus.* When tobacco necrosis virus was first isolated from Salinas soil by means of Cleome, the two plants which contained the virus were taller than the four which did not contain the virus. The effect on plant size of virus infection of the roots has been studied with artichoke, barley, French bean, broad bean, mung bean, calendula, Cleome, clover, cotton, cowpea, cucumber, mallow, poppy, primula, radish, sugar beet, sunflower, and sweet william. It is believed that increased growth has resulted from root infection of mung bean, Cleome, French bean, and cucumber, but results have been inconsistent. The greatest increases in green weight have resulted when mung bean seedlings were inoculated at two or more days after seeding, held at about 16°C. for about two days, and later transferred to about 25°C. The increased growth has been observed for seedlings held continuously in the dark in petri dishes, and for plants in pots in the greenhouse. No specific symptoms of virus infection in the roots were observed, but the same strain of virus caused necrosis when inoculated into the leaves of mung bean, Cleome, French bean, and cucumber.

YATSU, LAWRENCE. *See* BOYNTON, DAMON

YEATMAN, C. W. *See* HOLST, M. J.

YENTSCH, CHARLES S. Woods Hole, Massachusetts. *Phytoplankton Pigments: A Physiological Index.* Ratios of phytoplankton chlorophyll *a* : plant carotenoid have been observed in coastal and offshore waters of New York during six cruises covering the period September 1956 to July 1957. When compared to the standing crop of chlorophyll *a*, the ratios are at times independent of chlorophyll *a* concentrations. When compared with factors favorable for phytoplankton growth, such as shallow mixing within the euphotic zone and abundant nitrate and phosphate, high ratios prevail. When compared to unfavorable factors of deep mixing or little mixing and low nutrients, low ratios prevail. During summer the disappearance of nitrate from surface water closely parallels decreases in the pigment ratio, suggesting that limiting conditions are imposed by low concentrations of this element.

YOFFE, M. D. *See* YAKOVLEV, M. S.

YOUNG, ROY E. *See* BIALE, JACOB B.

ZAKIROV, S. Z. *See* ZONAREV, V. G., *et al.*

ZALENSKY, O. V., and V. L. KOMAROV. Academy of Sciences, Leningrad. *Interrelationships between Respiration and Photosynthesis.* The chlorophyllous cells represent a well-organized system in which the functions of photosynthesis and respiration are distributed among different organelles (chloroplasts and mitochondria). The interrelations between photosynthesis and respiration in the assimilating cells are not quite clear as yet. The main object of our investigation was to separate the photosynthetic from the respiratory carbon dioxide exchanges between the illuminated leaves and the surrounding atmosphere. Different methods, mainly those of quantitative radiometry, were applied (Zalensky, Voznesensky and Semikhatova, 1958). It has been shown that at the saturating light intensities a decrease of the respiratory carbon dioxide output occurs in normally assimilating leaves. Amounting to 85 to 90 per cent of the respiration in dark, in some cases, this decrease can be even greater (up to a complete cessation of carbon dioxide output). The range of the decrease of respiratory carbon dioxide evolution depends on both the amount and the spatial distribution of the assimilating and non-assimilating components of the plant tissues and cells. It seems probable that the CO_2 exchange of the normally functioning leaves can be either of the photosynthetic (light) or of the respiratory (dark) type. From the standpoint of the energetics, photosynthesis and respiration can be substituted for each other, both being the means of cell catabolism. The treatment of the results obtained arouses some new problems. Thus, it is known that: (1) the respiratory carbon dioxide output is suppressed when the photosynthetic system is at work; (2) the chloroplasts are devoid of the enzyme systems conducting the glycolysis, the Krebs cycle and the terminal oxidations (James and Das, 1957); (3) the photosynthetic and the respiratory turnover have common enzymes and intermediate products; (4) by changing the respiratory turnover we strongly affect the distribution of the labeled carbon absorbed in the subsequent photosynthesis (Zalensky, 1955). These facts are indicative of close metabolic interrelations between the chloroplasts and mitochondria. At the same time, Arnon and others consider all the photosynthetic turnover of carbon as occurring in the isolated chloroplasts. But it is doubtful whether in their experiments the chloroplasts were not contaminated with mitochondria. Consequently, the status of the problem of the interrelations between the respiration and the photosynthesis depends upon the elucidation of the question whether there exists a functional dependence between the chloroplasts and the mitochondria.

ZALIK, SAUL, and R. A. MILLER. University of Alberta. *Filters that Isolate Narrow Regions of the Spectrum for Plant Growth Studies.* The spectral characteristics of different kinds of colored plastic sheets were determined. Plexiglass sheets of the selected colors were fabricated into filters which contain a 10 cm. aqueous layer of desired salt concentration. This filter system provides a means of isolating fairly narrow bands of the spectrum. These filters are seated in light-tight growth boxes. Construction and operation of the filters, the light source, and the boxes, and the required air-conditioning will be discussed.

ZAK, B. University of Georgia. *Littleleaf Disease of Shortleaf Pine (Pinus echinata Mill.).* Littleleaf, a disease of pine in the Piedmont region of the southeastern United States, is responsible for much mortality and growth reduction. Shortleaf pine (*Pinus echinata* Mill.) is primarily affected. Littleleaf is characterized by a gradual dying of trees over 20 years of age accompanied by shortening and chlorosis of needles, reduced growth, and general unthriftiness.

The disease is usually associated with eroded and shallow soils underlain by heavy, plastic, and poorly drained clays. It has been demonstrated to be the product of several factors. Chief among these is damage to the root system by the soil fungus *Phytophthora cinnamomi* Rands. Adverse soil conditions, including poor drainage and aeration, low fertility, and a deficit of available water during the growing season retard root regeneration and cause a gradual decline leading to littleleaf. Inherent vigor of the tree conditioned by age and the environment probably influences the susceptibility of the host to littleleaf. Any factor which decreases vigor aggravates the rate of decline from this disease.

ZEEVAART, JAN A. D. Agricultural University, Wageningen, Netherlands. *Results and Limitations of Grafting in Studies on Flowering.* Based upon the author's results obtained in grafting experiments the following conclusions and ideas are put forward. (1) Flowering of receptors cannot simply be explained by removal of flower-inhibiting leaves from the receptor; transmission of a "floral stimulus" from donor to receptor must be assumed. (2) The relative insensitivity of young plants to the inductive daylength ("juvenile phase") is due to the fact that leaves formed early are much less sensitive than later developed ones, that is, the former produce no or only small amounts of floral stimulus. (3) Transmission of the floral stimulus does not take place from donor to receptor until a functional phloem continuity between both partners has been established. (4) Generally only related species are graft-compatible; in view of this limitation the question as to the similarity of the floral stimuli in various plants cannot be solved by means of the grafting technique. (5) Grafting experiments cannot furnish the decisive proof for the existence of one single flower-inducing substance. Transmission of the floral stimulus (deduced from the appearance of flower buds) is always so closely correlated with the possibility of phloem transport from donor to receptor that it remains possible that the floral stimulus is only a definite combination of nutrients which is different from the combination supplied by non-induced leaves.

ZHUKOVSKY, P. Institute of Plant Industry, Leningrad. *Recent Data on the Origin of Cultivated Plants.*

ZIEGLER, HUBERT. Botanisches Institut der Technischen Hochschule, Darmstadt, Germany. *Our Knowledge of Translocation in Rays.* According to their appearance, their arrangement, and their anatomical structure, rays are radial connecting systems between the big vertical systems of conduction. The structure of the rays and experimental evidence show that rays are not necessary for the conduction of water from the sapwood to the growing cambium and phloem tissue; the rays are necessary, however, to supply water from the sapwood to the heartwood. Ringing experiments and experiments with isotopes reveal that even radial salt transport, partly at least, follows the rays. Without a doubt, the assimilates are translocated from the phloem through the rays into the wood, and this is especially evident in ringing experiments. A centrifugal transport through the wood rays towards the cambium has not been demonstrated as yet, but it probably exists. The passage of assimilates from the sieve tubes into the rays probably takes place with the help of the Companion or Strasburger cells. Recent anatomical research on the cambium gives evidence that the supply of nutrients to the growing cambium is affected by the rays.

The cambium initials for the rays are unique: they are meristematic cells through which an intensive transport of material constantly passes. Do the amount and the speed of translocation of assimilates in rays correspond to a simple diffusion? Over short distances, such as in the transport of materials from the phloem to the cambium (Munch, 1930) or from the phloem to the xylem in herbaceous plants (Mason and Maskell, 1928), diffusion seems to be sufficient. But it can be demonstrated that for transport over maximal distances diffusion in the rays is not sufficient, and accelerating mechanisms must be assumed. For the radial transport of gases, too, the rays play an important part.

ZIMMERMANN, MARTIN H. Harvard University. *Removal of Substances from the Phloem.* Studies on the transport in the phloem of white ash (*Fraxinus americana* L.) over distances of 8 meters and more have been carried out. The requirements for a longitudinal mass movement through the sieve tubes along a turgor gradient are fulfilled. There is a positive gradient of total molar concentration in the downward direction of the tree during the summer. This gradient disappears immediately after defoliation. The longitudinal permeability of the sieve tubes to sugar solutions is indicated by ready exudation (see also paper describing exudation from severed aphid stylets). The cytoplasm lining the side walls of the sieve tubes, however, is semipermeable. This semipermeability appears to be maintained by a metabolically controlled entry and exit of solute molecules, that is, an enzymatic release (secretion) into and removal from the sieve-tube vacuole. This lateral "pumping" across a membrane may establish and maintain a longitudinal turgor gradient along which a longitudinal passive flow could occur. Defoliation experiments suggest that removal of sugars from the sieve tubes is a reversible process which operates under remote control from the leaves.

ZIMMERMAN, WALTER. University of Tübingen. *Phylogenetic Shifting of Organs, Tissues, and Phases in Pteridophytes.* The classic morphology believed in homotopy and homochrony of organs and tissues; in phylogenetic changes this "old morphology" assumed only the possibility of heteromorphy. But comparative studies in fossil and recent plants as well as experiments inform us that, in various cases, determining factors migrate in space and time. By this migrating the morphology, anatomy, and life history of plants are considerably changed. Migrations in space as cases of heterotopy are realised in the shifting of leaves or parts of leaves (e.g., pinnae and pinnules). This heterotopy can be followed very clearly in pteridophylls. Pinnules of palaeozoic pteridophylls are mostly in alternating and catadromic position. In some mesozoic pteridophylls, the initiation of the shifting can be seen at the leaf tip. The tip shows an anadromic structure, while the base still has a catadromic pinnule structure. Today many Polypodiaceae have an anadromic structure in the entire leaf, whereas others still possess a catadromic pinnule base. This phylogenetic shifting of anadromy from top to base is surprising because in ontogeny a different way is found. Also, the youngest pteridophylls of Polypodiaceae, such as *Athyrium filix femina* with catadromic base of some pinnae, have a total anadromic structure. These different structures of fern leaves are also important for fern taxonomy. The antagonistic shifting of stelary and parenchymatous tissues is an indication for heterotopy of tissues. In most cases of heterotopy there is a hologenetic shifting of determining factors. Tissues and organs arise at the points of their final placement. Heterochrony or shifting in time can be demonstrated in many life histories, for example, as neoteny in the development of sporophytes and gametophytes or as alteration of nuclear phases.

ZINGER, N. V. *See* PODDUBNAYA-ARNOLDI, V. A.; PODDUBNAYA-ARNOLDI, V. A., ——— *et al.*

ZOBEL, BRUCE J. North Carolina State College. *Juvenile Wood in Loblolly Pine (Pinus taeda).* Near the pith, the wood produced has characteristics much different from those further out. These wood characteristics are described, with emphasis on specific gravity and cellulose yields. Size and duration of juvenile core are discussed, and the importance of the recognition of this juvenile core in wood genetic studies is emphasized. The juvenile core can be utilized as a means of predicting the wood characteristics of the mature tree.

ZUCK, ROBERT K., and PHILIPP LINDENMEYER. Drew University, Madison, New Jersey. *Responses of Roots of Red Kidney Bean and Corn to Extracts of Coralloid Roots of Cycads and to Cultures of Anabaena Isolated from Coralloid Roots.* Both corn and bean roots when grown between wet paper toweling and the sides of glass jars responding by growing up rather than down when treated with extract of coralloid roots applied in lanolin paste. Similar results were obtained when agar on which *Anabaena* isolates were grown was applied. These responses occur in 24-48 hrs. and do not appear to be similar to those obtained from tri-iodo-benezoic acid.

ZURBICKI, Z. I. Academy of Sciences, Moscow. *Dependence of Mineral Composition of Plants on the Environmental Conditions.* The contents of mineral elements in a plant are determined not only by the nutrient substrate but by the climatic conditions as well. The use of the leaf diagnostics requires the knowledge of the effects which various climatic factors produce upon the leaf mineral composition. The content of mineral elements in the leaves of tomatoes grown in pots in greenhouses and in the open air, in spite of the fact that soil treatment was the same, varied considerably. Thus, the leaves from the greenhouse contained 2.07 per cent N, 0.53 per cent P_2O_5, and 2.9 per cent K_2O; the others contained 2.47 per cent, 1.10 per cent, and 2.34 per cent respectively. Moreover, the effect of fertilizers was not in accordance with these analysis data: the yield of the greenhouse plant increased following the application of N only by 8 per cent, while that of the open air plant by 77 per cent. The yield rise after the addition of P_2O_5 was almost the same, 10 per cent and 13 per cent respectively. Studies of absorption of nutrient elements by plants showed that temperature variations caused immediate changes in the rate of absorption of nutrient elements. At lower temperatures, starting from optimal to 10-12°C., absorption of phosphorus by plants is very slow; at 4-5°C. the worst assimilated is nitrogen. Detailed study of the role the climate factors play in the mineral nutrition of plants would enable us to substantiate the use of foliar analysis and to develop the most rational system of application of fertilizers.

ZWEIG, GUNTER, and J. E. DEVAY. University of California. *On the Biosynthesis of Gibberellins by Gibberella fujikuroi.* In order to elucidate the biosynthetic pathway of gibberellic acid (GA) by the fungus *Gibberella fujikuroi*, several C^{14}-labeled substrates were used as carbon sources in the media. Among these compounds were C^{14}-1-acetate, C^{14}-2-acetate, C^{14}-2-mevalonic acid, and uniformly labeled C^{14}-sucrose, glucose, and fructose. Under the described experimental conditions, only acetate seemed to serve as an efficient carbon source for GA. The over-all carbon-to-carbon yield, corrected for CO_2 evolution, was obtained from four separate experiments. The experimental ratio for the efficiency of C^{14}-2-acetate/C^{14}-1-acetate gave an average value of 1.49. The possible significance of this ratio will be discussed. When C^{14}-2-mevalonic acid was fed to cultures of the fungus, a metabolite was formed which was not identical with GA. Mevalonic acid or its metabolite did not stimulate GA production. Only traces of C^{14}-GA were formed from C^{14}-mevalonic acid or any of the C^{14}-sugars. The results from mevalonic acid indicate that it may not be a direct precursor of GA, as postulated by Birch *et al.* (Proc. Chem. Soc. London, 192-193, 1958). A method will be described for the isolation of C^{14}-GA from filtrates of *G. fujikuroi*, grown on media containing C^{14}-acetate.